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FLOOD INSURANCE STUDY

ORIGINAL

CITY OF LUBBOCK, TEXAS
LUBBOCK COUNTY

MARCH 18, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 480452

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NOTICE TO
FLOOD INSURANCE STUDY USERS

This Flood Insurance Study was revised on March 18, 1986. Users should refer to the Revision Description section (Section 9.0) of this text for further information.

Part or all of this Flood Insurance Study may be revised at any time. The user is therefore cautioned that a published map revision (i.e., a revised Flood Insurance Rate Map) may not include a reprinting of the text, tables, and/or profiles, resulting in a discrepancy between the revised map and the original study components. It is the responsibility of the user to consult with community officials to obtain the most current Flood Insurance Study components.

Initial Flood Insurance Study Effective Date: September 2, 1982

Flood Insurance Study Revised: March 18, 1986

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
CITY OF LUBBOCK, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Lubbock, Lubbock County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Lubbock to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Albert H. Halff Associates, Inc., for the Federal Emergency Management Agency under Contract No. H-4648. This study was completed in June 1980.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the study contractor, FEMA, and the representatives of the City of Lubbock in March 1978. Results of the hydrologic and hydraulic analysis were coordinated with the City of Lubbock Engineering Department.

On May 14, 1981, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, FEMA, and community officials. The study was acceptable to the community.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Lubbock, Lubbock County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Lubbock were determined by FEMA with community and study contractor consultation at the meeting in March 1978.

Floods caused by the North Fork Double Mountain Fork Brazos River from the downstream corporate limit to the upstream corporate limit and Yellowhouse Draw from its confluence with the North Fork of the Brazos River to the upstream corporate limit were studied.

The playa systems of Lubbock were studied to determine the 10-year, 50-year, 100-year and 500-year flood levels only. Floodways were not developed for the Playa systems.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction between now and March 1983.

2.2 Community Description

The City of Lubbock is located in the Panhandle section of Texas in the center of Lubbock County. The city is approximately 325 miles northwest of Dallas and about 340 miles northeast of El Paso. The population was estimated to be 163,525 in population 1975 (Reference 1).

The climate of the Panhandle of Texas is semiarid. Summer and winter average monthly temperatures range from 92 degrees F to 25 degrees F, respectively. Average annual precipitation is 18 inches (Reference 1). Precipitation is variable.

The North Fork Double Mountain Fork Brazos River flows south through the eastern section of Lubbock. The contributing drainage area is 219 square miles.

Yellowhouse Draw is a tributary of the North Fork Double Mountain Fork Brazos River. Yellowhouse Draw flows southeast throughout the north central section of Lubbock. Its contributary drainage area is 111 square miles and it is 53 miles long.

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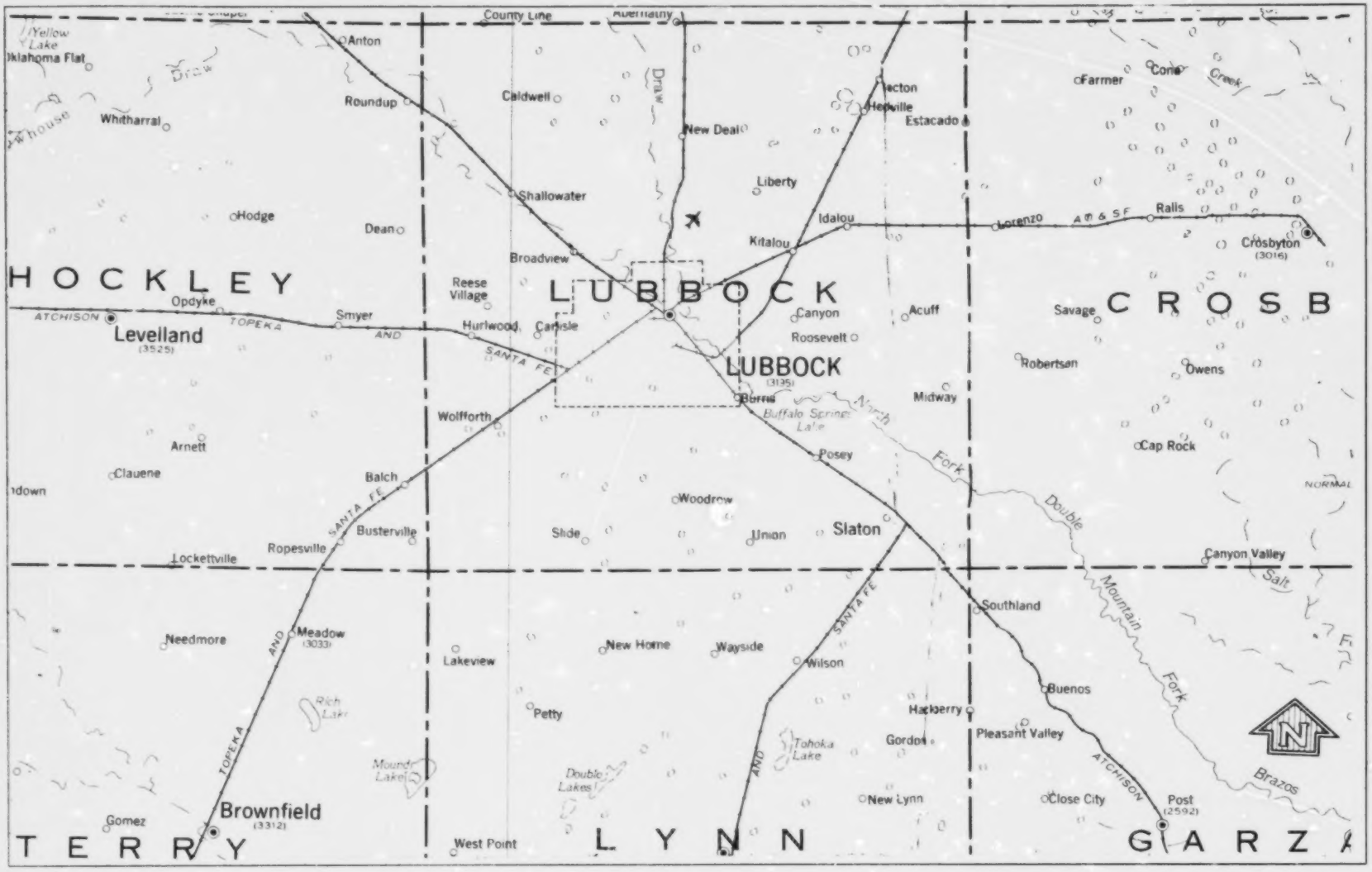

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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The main drainage features of Lubbock are the playa systems which exist throughout the city. The playas are large saucer-like depressions in the topography. Large rainfall amounts fill the playas and several can overflow. The overflow can pass from playa to playa creating a system of interconnected flow paths through the city.

The playa systems studied were the following: System A from playa 49 to Yellowhouse Draw, System B from playa 106 to playa System A, System C from playa 105 to Yellowhouse Draw, System D from playa 103 to North Fork Double Mountain Fork Brazos River, System E from playa 39 to North Fork Double Mountain Fork Brazos River, System F from playa 82 to playa 17, and System G from playa 85 to playa 88. System H is playa 55. System I from playa 67 to North Fork Double Mountain Fork Brazos River, and System J from playa 62 to playa 66.

2.3 Principal Flood Problems

Past history in the City of Lubbock indicates that the most likely time of year for flooding to occur is between May and October. Generally, flood-producing rainfall is of two types, thunderstorm and frontal storms. Thunderstorms frequently cause flash flooding from small drainage basins, while frontal storms are more likely to cause flooding in watersheds having relatively large areas.

There have been few major floods in the City of Lubbock. Floods have occurred on May 7, 1949, and May 11, 1970.

The rain storms of May 11, 1970 were caused by a tornado which passed through the city.

2.4 Flood Protection Measures

At present, there are no significant reservoirs upstream of the City of Lubbock.

Nonstructural measures of flood protection are also being utilized to aid in the mitigation of future flood damage. These methods include flood insurance and flood-plain zoning. Flood insurance under Public Law 73-234 is now available to the citizens of Lubbock. These regulations are used to control flood plain development and to prevent future flood damage.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly

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termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Discharges for the North Fork Double Mountain Fork Brazos River and Yellowhouse Draw were determined by a modification of the U.S. Department of the Interior, U.S. Geological Survey (USGS) procedures outlined in Reference 2. The procedure relates basin characteristics to flood frequency curves for basins in Texas. Flood frequency curves for gaged streams are calculated using the standard Log-Pearson Type III method as outlined by the Water Resources Council (Reference 3). The resulting flood flow frequency curves are related by regression analysis to basin characteristics such as drainage area, stream, length, and slope (Reference 4). The resulting empirical equations for each flood frequency are used for ungaged areas. Discharges for the playa systems were determined by rainfall-runoff analysis based on unit hydrograph theory and employing Soil Conservation Service (SCS) dimensionless unit hydrograph and curve number theory (References 5 and 6). Rainfall amounts for the 10-year, 50-year, and 100-year frequency floods are from U.S. Weather Bureau data (Reference 7). Discharges for the 500-year frequency flood are extrapolated from frequency curves. A summary of all discharges used in detailed study areas can be found in Table 1, "Water-Surface Elevations and Outflow Discharges" and Table 2, "Summary of Discharges".

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Table 1
Water-Surface Elevations and Outflow Discharges
For Lubbock Playas

Playa	Peak Water-Surface Elevation (N.G.V.D.)				Peak Outflow Discharge (c.f.s.)			
	10-Year	50-YEAR	100-YEAR	500-YEAR	10-YEAR	50-YEAR	100-YEAR	500-YEAR
System A1								
Playa 49	3248.6	3248.7	3248.8	3249.3	150	300	430	735
System A2								
Playa 50	3230.9	3231.1	3231.2	3231.4	*	20	32	58
System B								
Playa 51	3225.3	3225.5	3225.6	3225.9	*	45	55	105
Playa 48	3257.3	3257.6	3257.8	3258.2	*	30	40	60
Playa 106	3266.0	3268.0	3268.7	3270.3	**	**	**	62
System C								
Playa 52	3227.9	3227.95	3227.96	3228.07	*	110	150	370
Playa 46	3232.6	3232.9	3233.0	3233.3	*	100	135	310
Playa 47	3247.3	3248.1	3248.4	3248.7	*	55	100	250
Playa 71	3260.4	3260.7	3260.8	3261.1	45	100	135	230
Playa 105	3271.2	3272.9	3273.0	3273.3	**	*	*	40
System C1								
Playa 53	3219.6	3220.6	3221.0	3221.1	**	**	*	*
System D1								
Mose Hoed Park Playa	3190.8	3195.2	3195.4	3195.7	**	135	270	625
Stumpy Hamilton Park Playa	3202.5	3203.5	3203.9	3204.1	35	150	225	685
Green Acres Park Playa	3209.9	3210.7	3210.9	3211.8	30	150	210	395
Tech Terrace Park Playa	3207.4	3210.7	3210.86	3211.8	**	*	*	230
Maxey Park Playa (Playa 43)	3222.5	3225.5	3225.6	3225.9	*	80	125	300
Playa 42	3237.7	3238.4	3238.9	3239.6	*	*	*	105
Playa 41	3263.0	3263.6	3263.8	3264.1	*	*	*	25
Playa 40	3260.0	3261.6	3262.1	3263.3	**	**	**	**

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Table 1 - continued
Water-Surface Elevations and Outflow Discharges
For Lubbock Playas

Playa	Peak Water-Surface Elevation (N.G.V.D.)				Peak Outflow Discharge (c.f.s.)			
	10-YEAR	50-YEAR	100-YEAR	500-YEAR	10-YEAR	50-YEAR	100-YEAR	500-YEAR
System D2								
Playa 44	3225.2	3226.5	3227.9	3227.7	120	200	250	415
Playa 45 d/s	3241.4	3241.6	3241.7	3241.9	410	825	1,090	1,670
(no storage) u/s	3246.3	3246.6	3246.7	3246.9				
System E1								
K.N. Clapp Park Playa (Playa 21)	3199.8	3204.7	3207.0	3209.7	**	**	**	115
Playa 2C	3212.8	3213.0	3213.1	3213.4	110	255	345	595
Playa 19	3214.7	3215.1	3215.3	3215.6	90	210	295	535
Playa 23	3221.4	3221.9	3222.0	3222.5	55	135	180	365
Playa 24	3223.6	3227.0	3227.4	3227.9	**	*	80	215
Playa 25	3227.1	3227.7	3227.8	3228.2	*	125	160	335
Playa 26	3233.0	3233.3	3233.6	3234.0	85	290	470	745
Playa 27	3237.1	3237.5	3237.7	3238.1	300	620	840	1,415
Playa 31	3254.0	3255.0	3255.3	3255.8	*	75	135	310
Playa 37	3262.2	3265.5	3266.0	3267.3	**	*	*	115
Playa 39	3268.3	3268.6	3268.7	3269.0	145	400	500	800
System E2								
Playa 22	3223.5	3224.7	3224.8	3225.0	**	*	*	50
System F								
Playa 17	3180.8	3184.7	3185.4	3187.0	**	**	**	**
Playa 18	3186.1	3186.3	3186.4	3187.0	*	*	*	85
System G1								
Playa 85	3200.4	3202.7	3203.7	3206.6	**	**	**	**
Playa 86	3219.9	3221.7	3222.0	3222.4	**	*	*	40
Playa 88	3228.0	3228.2	3228.3	3228.6	*	70	95	155
System G2								
Playa 87	3220.8	3221.2	3221.2	3221.4	**	*	*	100

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Table 1 - continued
Water-Surface Elevations and Outflow Discharges
For Lubbock Playas

Playa	Peak Water-Surface Elevation (N.G.V.D.) 10-YEAR	50-YEAR	100-YEAR	500-YEAR	Peak Outflow Discharge (c.f.s.) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
System H								
Playa 55	3215.5	3216.1	3216.4	3217.0	*	*	*	70
System I								
Playa 67	3190.5	3191.1	3191.1	3191.3	**	*	*	75
System J1								
Playa 66	3185.2	3192.9	3192.9	3193.0	**	*	70	130
Playa 64	3194.7	3195.8	3195.9	3196.0	**	*	*	75
Playa 62	3209.0	3209.8	3210.	3210.6	*	*	*	50
System J2								
Playa 63	3211.6	3212.5	3212.9	3213.3	**	**	**	*

*Flow of less than 50 c.f.s.
**No flow

TABLE 2 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS RIVER					
Downstream of Buffalo Road	219	3,180	8,740	12,600	26,100
Downstream confluence of Yellowhouse Draw	214	3,000	8,400	12,000	24,400
Upstream confluence with Yellowhouse Draw	104	1,200	3,500	5,200	12,900

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TABLE 2 - SUMMARY OF DISCHARGES-continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
YELLOWHOUSE DRAW					
Confluence with North Fork Double Mountain Fork Brazos River	111	1,800	4,900	6,800	14,900

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the City of Lubbock were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Cross sections for backwater analyses on the playa systems and portions of Yellowhouse Draw and North Fork of Brazos River were obtained by photogrammetric methods from aerial photographs flown in November 1978. Bridge openings, other structures and additional stream cross sections were surveyed in 1979.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

Channel roughness factors (Manning's "n") (Table 3) used in the hydraulic computations were chosen by engineering judgement based on field observations and analysis of aerial photographs of the streams and flood plain areas where possible. Roughness factors are calibrated using recorded flood data when possible. Channel Manning's "n" values on the streams range from 0.015 to 0.09 with flood plain Manning's "n" values ranging from 0.015 to 0.08.

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TABLE 3

MANNING'S ROUGHNESS COEFFICIENTS
NORTH FORK DOUBLE MOUNTAIN FORK
BRAZOS RIVER
AND
YELLOWHOUSE DRAW
FLOOD INSURANCE STUDY

Stream name	Manning's "n" Channel Maximum	Channel Minimum	Flood Plain Maximum	Flood Plain Minimum
North Fork Double Mountain Fork Brazos River	0.090	0.015	0.080	0.015
Yellowhouse Draw	0.080	0.030	0.070	0.035

Water-surface elevations of floods of the selected recurrence intervals on North Fork Brazos River and Yellowhouse Draw were computed through use of the Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Water-surface elevations of floods in the playa systems were computed through use of the SCS programs Technical Release-20, (TR-20) and Water-Surface Profiles (WSP) (Reference 9). Starting water-surface elevations for the storage were calculated using the slope-area method.

All elevations are referenced from the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929; elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream

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studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 5 feet. In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown. The topographic maps were updated by field investigation and by aerial photographs.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations, and therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 4). Floodways were not developed for the playa systems.

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
North Fork Double Mountain Fork Brazos River								
A	1,100	375[2]	2,784	4.5	3108.6	3108.6	3109.5	0.9
B	6,075	221	2,418	5.2	3122.6	3122.6	3122.8	0.2
C	12,910	400	4,827	2.6	3134.4	3134.4	3134.4	0.0
D	20,080	361	3,976	3.2	3141.0	3141.0	3142.0	1.0
E	27,900	800	7,269	1.7	3146.5	3146.5	3146.8	0.3
F	33,110	580	6,079	2.0	3155.9	3155.9	3156.4	0.5
G	40,780	215	1,001	5.2	3157.1	3157.1	3157.6	0.5
H	46,850	115	1,065	4.9	3171.9	3171.9	3172.4	0.5
I	52,270	475	2,610	2.0	3181.8	3181.8	3182.4	0.6
J	63,730	178	1,090	4.8	3195.3	3195.3	3195.8	0.5
K	68,320	365	1,604	3.2	3200.6	3200.6	3201.3	0.7
Yellowhouse Draw								
A	3,201	139	1,048	6.5	3158.5	3158.5	3159.2	0.7
B	6,150	294	3,203	2.1	3172.4	3172.4	3173.2	0.8
C	12,610	325	4,555	1.5	3181.0	3181.0	3181.1	0.1
D	16,806	370	7,515	0.9	3191.6	3191.6	3192.1	0.5
E*	24,600	134	676	10.1	3195.9	3195.9	3196.1	0.2

[1]Feet above a point 2,000 feet downstream of Buffalo Road for North Fork Double Mountain Fork Brazos River;
[2]feet above confluence with Brazos River for Yellow House Draw.
[2]Width extends beyond corporate limits. * Located outside corporate limits.

TABLE 4

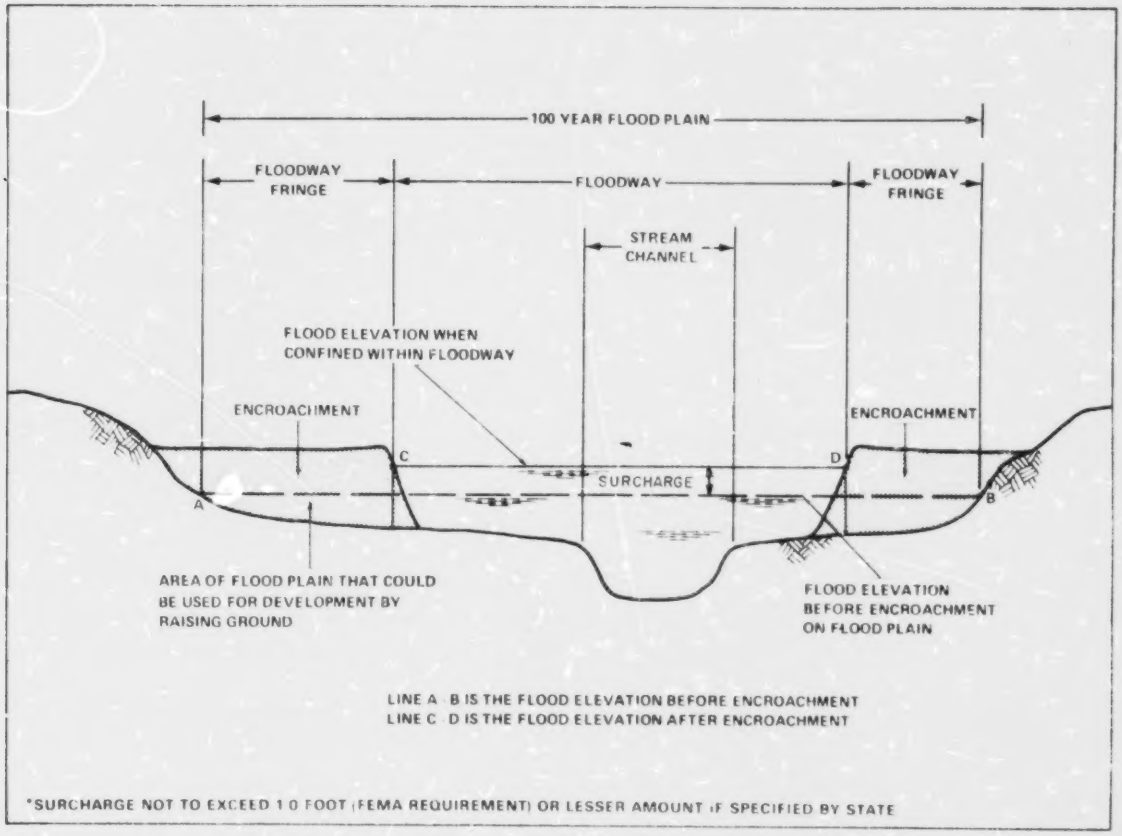
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

FLOODWAY DATA

NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS RIVER - YELLOW HOUSE DRAW



FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the City of Lubbock.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

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Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

The location of reaches determined for the flooding sources of the City of Lubbock are shown on the Flood Profiles (Exhibit 1) and summarized in the Flood Insurance Zone Data Table (Table 5).

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Lubbock was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A14, A16, and A18:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

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Zone C: Areas of minimal flooding.

Table 5, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Lubbock is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

A "Feasibility Report on the Canyon Lakes Project", prepared by Freese, Nichols and Enchess in 1960 discussed the proposed dams for North Fork Double Mountain Fork Brazos River and Yellowhouse Draw. The report does not have discharge-elevation dates for the streams. No other studies were found to exist at the time of this study.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Federal Center, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

1. Texas Almanac and State Industrial Guide 1978-1974, A.H. Belo Corporation, Dallas, Texas, 1977.

2. E.E. Schroeder and B.C. Massey, United States Department of the Interior Geological Survey, "Techniques for Estimating the Magnitude and Frequency of Floods in Texas," Water Resources Investigations 77-110, 1977.

3. United States Water Resources Council, "Guidelines for Determining Flood Flow Frequency", Bulletin 17A, Hydrology Committee, Revised June 1977.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
North Fork Double Mountain Fork, Brazos River							
Reach 1	0055	-5.3	-1.0	+3.5	055	A11	Varies
Reach 2	0035,0055	-5.9	-2.0	+6.9	060	A12	Varies
Reach 3	0030,0035	-3.6	-1.1	+3.2	035	A7	Varies
Reach 4	0030	-7.0	-1.4	+3.1	070	A14	Varies
Reach 5	0030	-4.2	-1.2	+3.3	040	A8	Varies
Reach 6	0010,0030	-2.9	-0.9	+2.7	030	A6	Varies
Yellowhouse Draw							
Reach 1	0030	-3.4	-0.8	+2.6	035	A7	Varies
Reach 2	0030	-6.0	-1.0	+2.6	060	A12	Varies
Reach 3	0030	-5.2	-1.0	+3.1	050	A10	Varies
Reach 4	0030	-3.9	-1.4	+5.0	040	A8	Varies
Reach 5	0030	-4.7	-1.6	+6.7	045	A9	Varies
Reach 6	0030	-2.8	-1.0	+4.7	030	A6	Varies
Reach 7	0025,0030	-9.1	-1.3	+3.1	090	A18	Varies
Reach 8	0025	-4.3	-0.7	+2.8	045	A9	Varies
Reach 9	0005	-2.5	-0.8	+2.6	025	A5	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

FLOOD INSURANCE ZONE DATA

NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS RIVER - YELLOW HOUSE DRAW

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Playa System A1							
Reach 1	0020,0025	-0.2	-0.1	+0.5	005	A1	3249
Playa System A2							
Reach 1	0025	-0.3	-0.1	+0.2	005	A1	3231
Playa System B							
Reach 1	0025	-0.3	-0.1	+0.3	005	A1	3226
Reach 2	0020,0025	-0.5	-0.2	+0.4	005	A1	3258
Reach 3	0020	-2.7	-0.7	+1.6	025	A5	3269
Playa System C							
Reach 1	0025	-0.06	-0.01	+0.11	005	A1	3228
Reach 2	0025	-0.4	-0.1	+0.3	005	A1	3233
Reach 3	0025	-1.1	-0.3	+0.3	010	A2	3248
Reach 4	0020,0025	-0.4	-0.1	+0.3	005	A1	3261
Reach 5	0020	-1.8	-0.1	+0.3	020	A4	3273
Playa System C1							
Reach 1	0025	-1.6	-0.7	+0.1	015	A3	3221
Playa System D1							
Reach 1	0030	-4.6	-0.2	+0.3	045	A9	3195
Reach 2	0030	-1.4	-0.4	+0.2	015	A3	3204
Reach 3	0025,0030	-0.1	-0.2	+0.9	010	A1	3211

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

FLOOD INSURANCE ZONE DATA

PLAYA SYSTEM A1 - PLAYA SYSTEM A2 - PLAYA SYSTEM B - PLAYA SYSTEM C - PLAYA SYSTEM D1

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Playa System D1 (continued)							
Reach 4	0025	-3.5	-0.2	+0.9	035	A7	3211
Reach 5	0025	-3.1	-0.1	+0.3	030	A6	3226
Reach 6	0025	-1.2	-0.5	+0.7	010	A2	3239
Reach 7	0020,0025	-0.8	-0.2	+0.3	010	A2	3264
Reach 8	0020,0040	-2.1	-0.5	+1.2	020	A4	3262
Playa System D2							
Reach 1	0025	-1.4	-0.3	+0.8	015	A3	Varies
Reach 2	0025	-0.3	-0.1	+0.2	005	A1	Varies
Playa System E1							
Reach 1	0050	-7.2	-2.3	+2.7	070	A14	3207
Reach 2	0050	-0.6	-0.2	+0.3	005	A1	3215
Reach 3	0045,0050	-0.6	-0.1	+0.5	005	A1	3222
Reach 4	0045	-3.8	-0.4	+0.5	040	A8	3227
Reach 5	0045	-0.6	-0.2	+0.4	005	A1	3238
Reach 6	0045	-1.3	-0.3	+0.5	015	A3	3255
Reach 7	0040	-3.8	-0.5	+1.3	040	A8	3266

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

FLOOD INSURANCE ZONE DATA

PLAYA SYSTEM D1-PLAYA SYSTEM D2-PLAYA SYSTEM E1

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Playa System E1 (continued)							
Reach 8	0040	-0.9	-0.2	+0.4	010	A2	Varies
Reach 9	0040	-0.4	-0.1	+0.3	005	A1	3269
Playa System E2							
Reach 1	0045	-1.3	-0.1	+0.2	015	A3	3225
Playa System F							
Reach 1	0050	-4.6	-0.7	+1.6	045	A9	3185
Reach 2	0050	-0.3	-0.1	+0.6	005	A1	3186
Playa System G1	0040						
Reach 1	0045,0050	-3.3	-1.0	+2.9	035	A7	3204
Reach 2	0045,0050	-2.1	-0.3	+0.4	020	A4	3222
Reach 3	0045	-0.3	-0.1	+0.3	005	A1	3228
Playa System G2							
Reach 1	0045	-0.4	-0.0	+0.2	005	A1	3221

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

FLOOD INSURANCE ZONE DATA

PLAYA SYSTEM E1-PLAYA SYSTEM E2-
PLAYA SYSTEM F-PLAYA SYSTEM G1-PLAYA SYSTEM G2

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Playa System H							
Reach 1	0010,0030	-0.9	-0.3	+0.6	010	A2	3216
Playa System I							
Reach 1	0035	-0.6	-0.0	+0.2	005	A1	3191
Playa System J1							
Reach 1	0035	-6.2	-0.0	+0.1	060	A12	3193
Reach 2	0035	-1.2	-0.1	+0.1	010	A2	3196
Reach 3	0030,0035	-1.0	-0.2	+0.6	010	A2	3210
Playa System J2							
Reach 1	0035	-7.8	-0.0	+0.1	080	A16	3193
Reach 2	0030,0035	-1.3	-0.4	+0.4	015	A3	3213

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

FLOOD INSURANCE ZONE DATA

PLAYA SYSTEM H - PLAYA SYSTEM I - PLAYA SYSTEM J1 - PLAYA SYSTEM J2

4. United States Department of Interior, Geological Survey, Stream Flow Basin Characteristics, File Contents for Texas, Revised March 6, 1978.

5. United States Department of Agriculture, Soil Conservation Service. National Engineering Handbook, Section 4, Hydrology, U.S. Government Printing Office, 1972.

6. United States Department of Agriculture, Soil Conservation Service. Technical Release No. 20. Computer Program for Project Formulation, Hydrology. Central Technical Unit, Soil Conservation Service, May 1965.

7. Hershfield, David M., United States Department of Commerce, Weather Bureau. Technical Paper No. 40: Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 Hours and Return Periods from 1 to 100 Years. U.S. Government Printing Office, May 1961.

8. United States Army Corps of Engineers, Hydrologic Engineering Center. Computer Program 723-X6-L202A HEC-2 Water-Surface Profiles, Davis, California, November 1976 with August 1977 updates.

9. Albert H. Halff Associates, Inc., Hydrology and Hydraulics of Flood Plain Studies, Albert H. Halff Associates, Inc., 1976.

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TEXT REVISIONS
CITY OF LUBBOCK, TEXAS

9.0 REVISION DESCRIPTION

9.1 Purpose

The purpose of this revision is to incorporate new and/or revised data into the currently effective Flood Insurance Study for the City of Lubbock, Lubbock County, Texas. This Revision Description is intended to provide updated information which aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

9.2 Acknowledgments

The hydraulic analyses for this Revision Description were performed by Hugo Reed and Associates, Inc. The Federal Emergency Management Agency (FEMA) reviewed and accepted the data for purposes of this revision. This study was completed in December 1984.

9.3 Scope

This revision modified the hydraulic analysis for a portion of Playa System E1 from Playa 27 to Playa 31. Flood boundaries and base flood elevations were changed to reflect this reanalysis. These changes are reflected on Panel 45 of the Flood Insurance Rate Map (FIRM) and the corresponding profile panel. The revised flood boundaries were delineated using topographic maps (Reference 1). There is a channel distance discrepancy of approximately 870 feet on Playa System E1 between the FIRM and the profile from the intersection of Utica Avenue and 58th Street to Slide Road. This discrepancy will not have any effect on the flood profiles.

9.4 Hydrologic and Hydraulic Analyses

The hydraulic model from the previously effective study (section 3.2) for the City of Lubbock provided the necessary information to reflect the changes on Playa System E1 (Reference 2).

9.5 Revisions Bibliography

1. Albert H. Halff Associates, Topographic Maps, Scale 1"=200', Contour Interval 1 Foot: Lubbock, Texas.

2. Federal Emergency Management Agency, Flood Insurance Study, City of Lubbock, Lubbock County, Texas, Washington, D. C., March 2, 1982.

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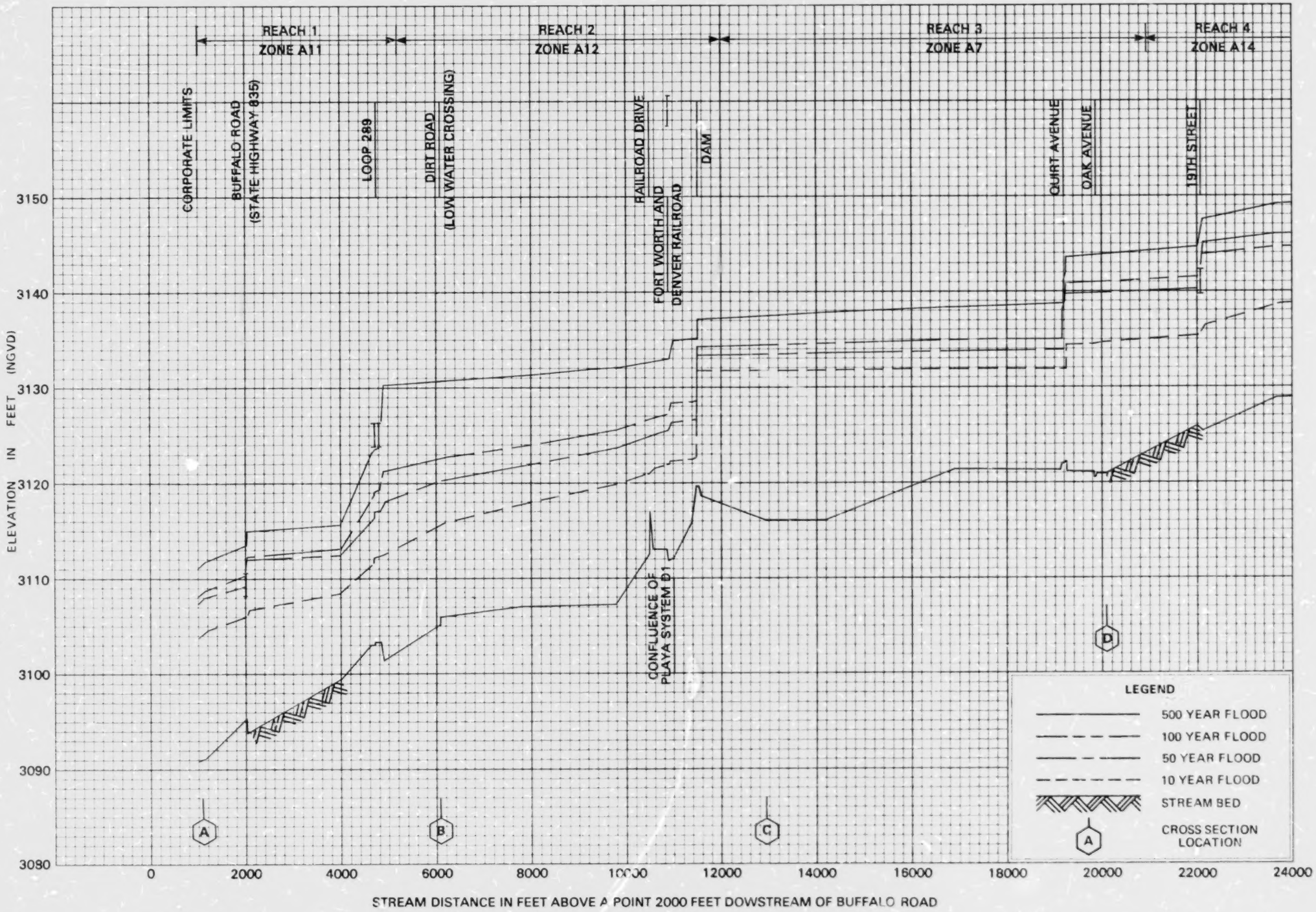

FLOOD PROFILES

NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

01P

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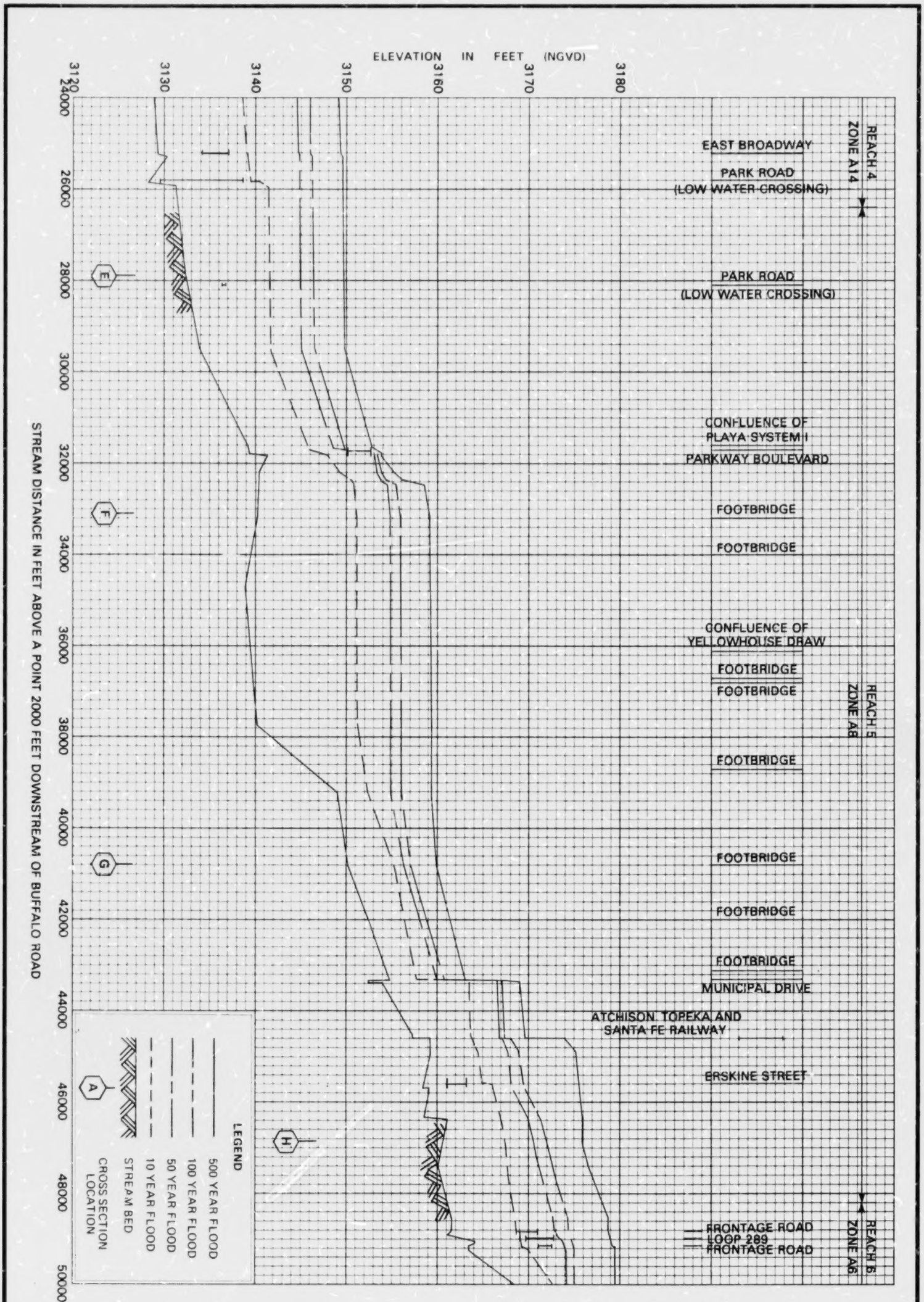

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

02P

FLOOD PROFILES

NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS RIVER

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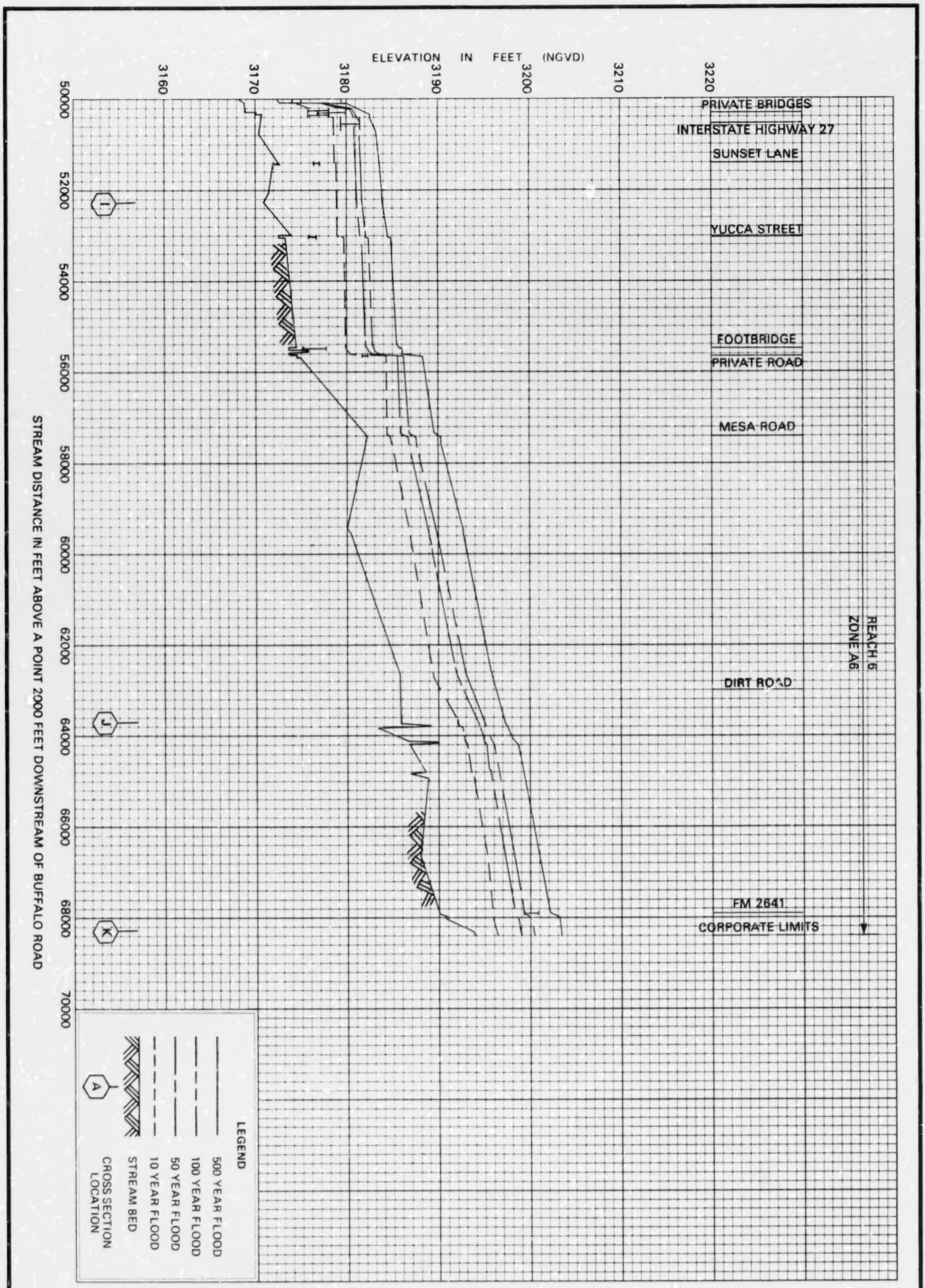

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

03P

FLOOD PROFILES

NORTH FORK DOUBLE MOUNTAIN FORK BRAZOS RIVER

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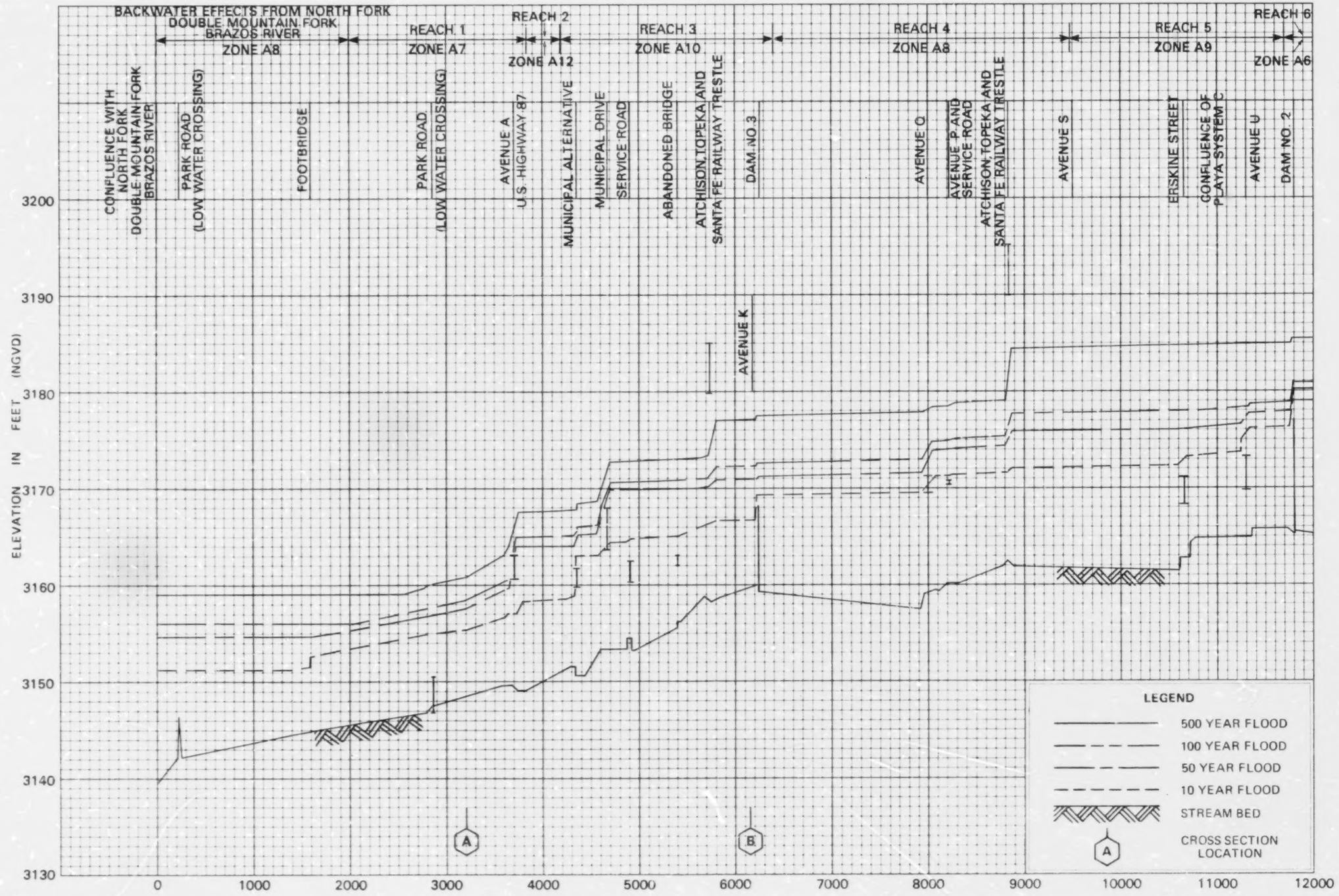

FLOOD PROFILES

YELLOW HOUSE DRAW

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

04P

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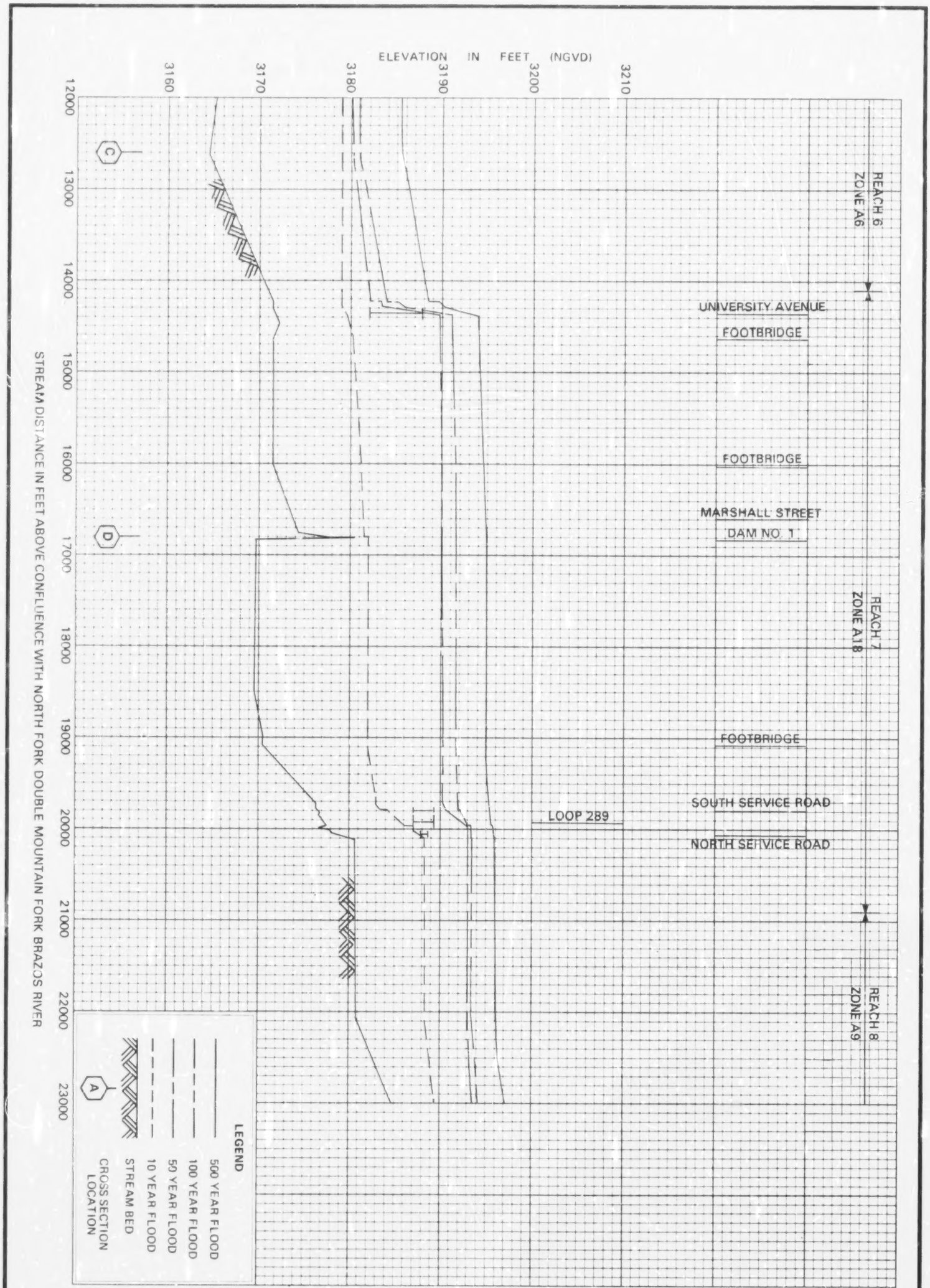

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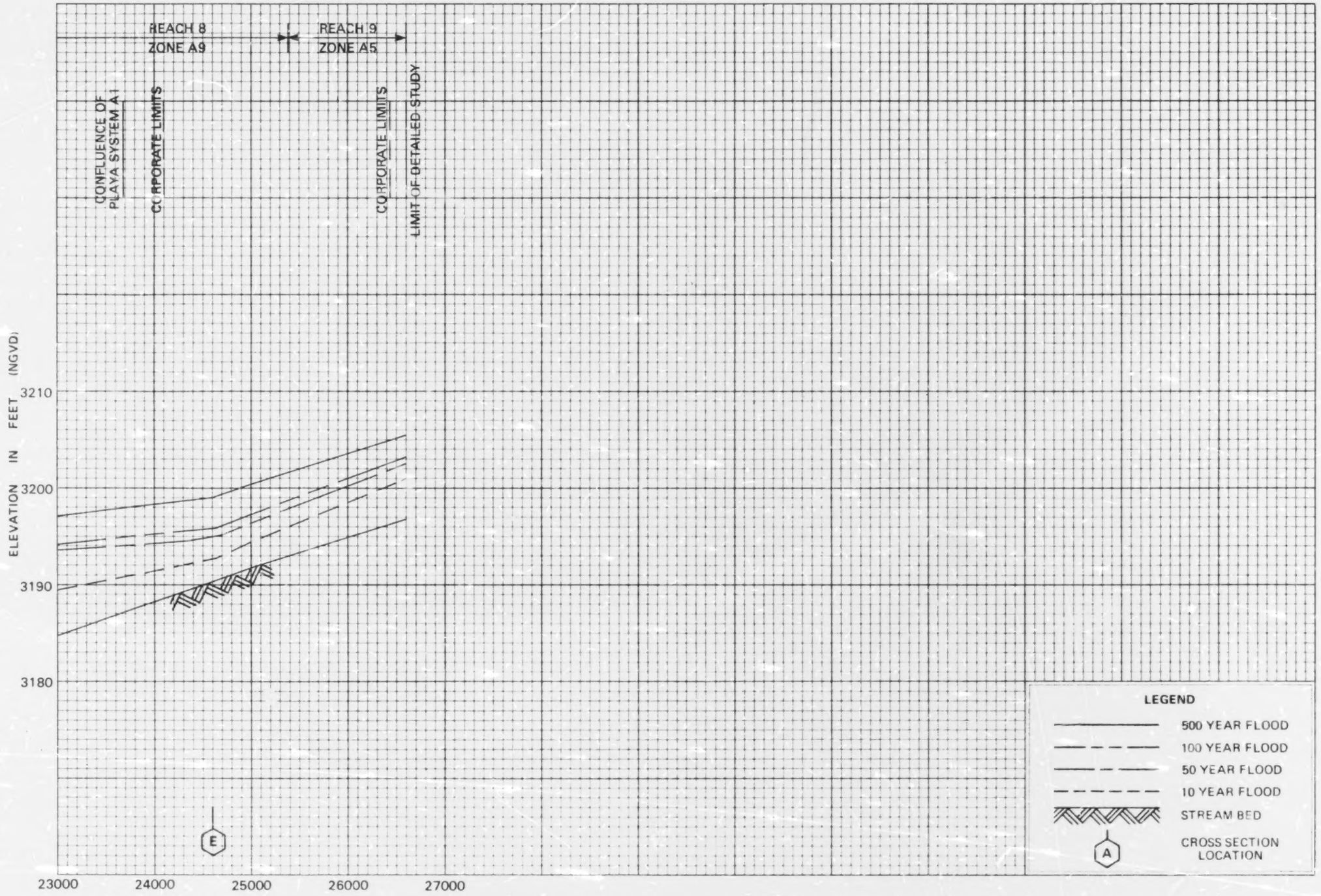

FLOOD PROFILES

YELLOW HOUSE DRAW

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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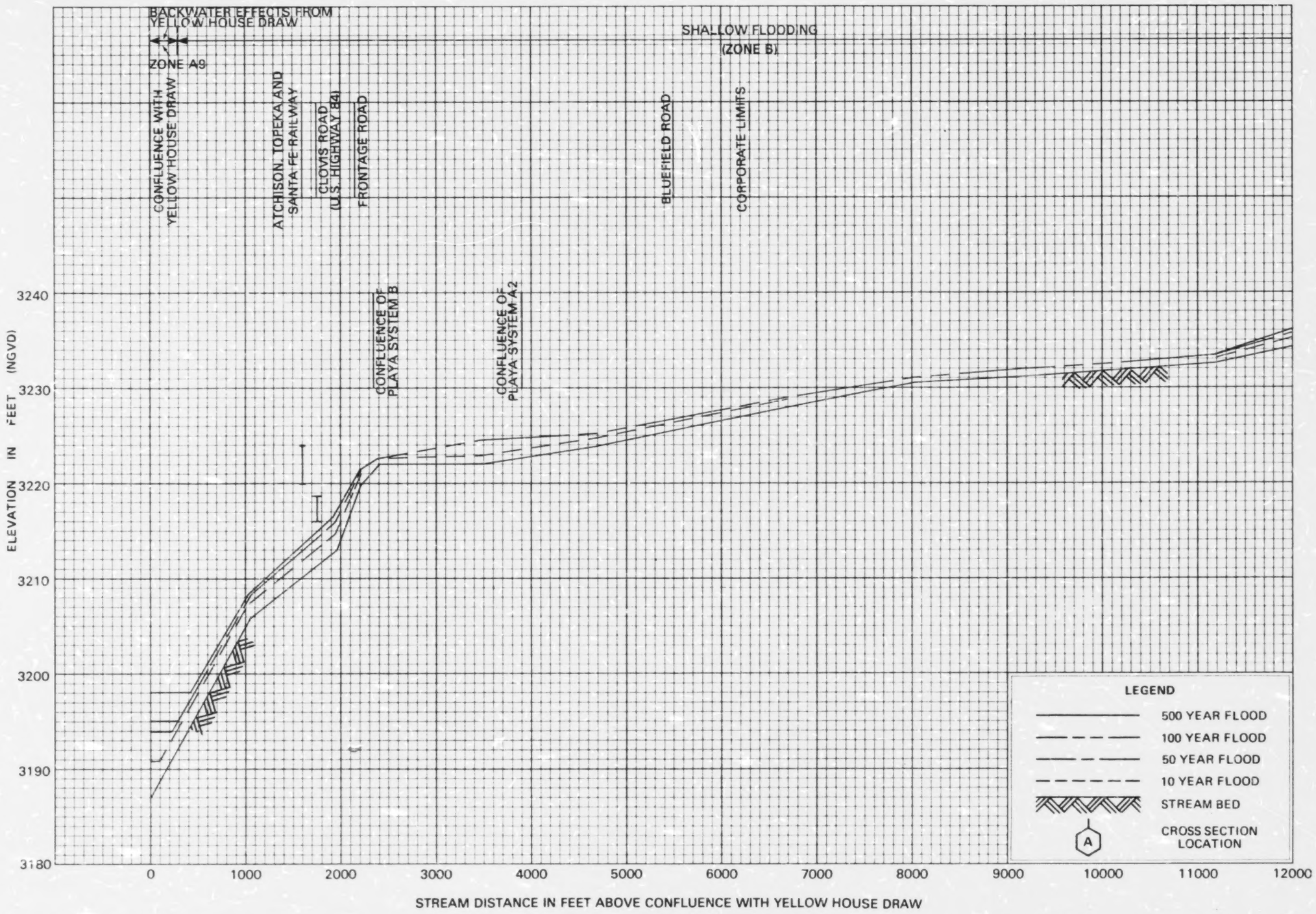

FLOOD PROFILES

PLAYA SYSTEM A1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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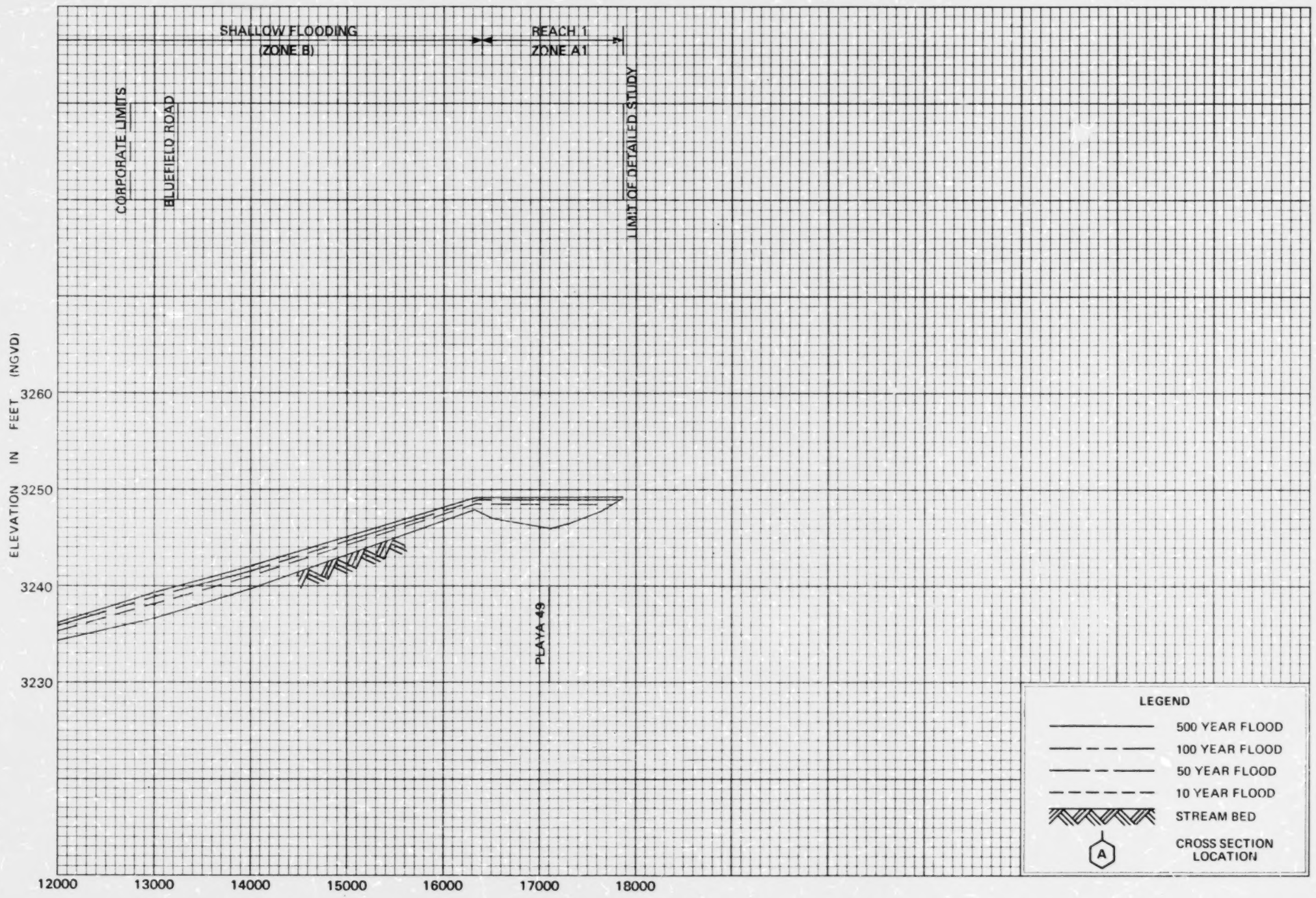

FLOOD PROFILES

PLAYA SYSTEM A1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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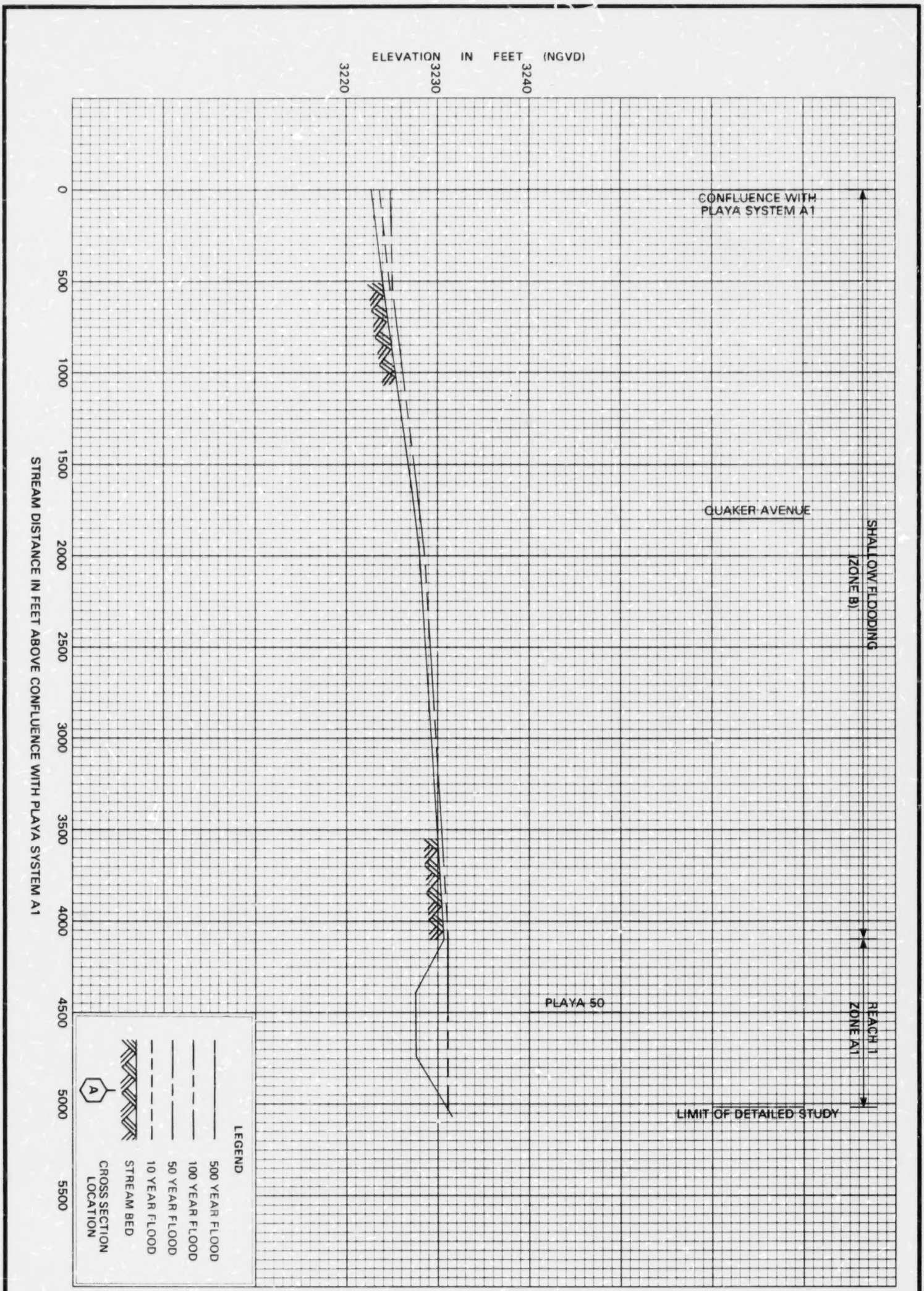

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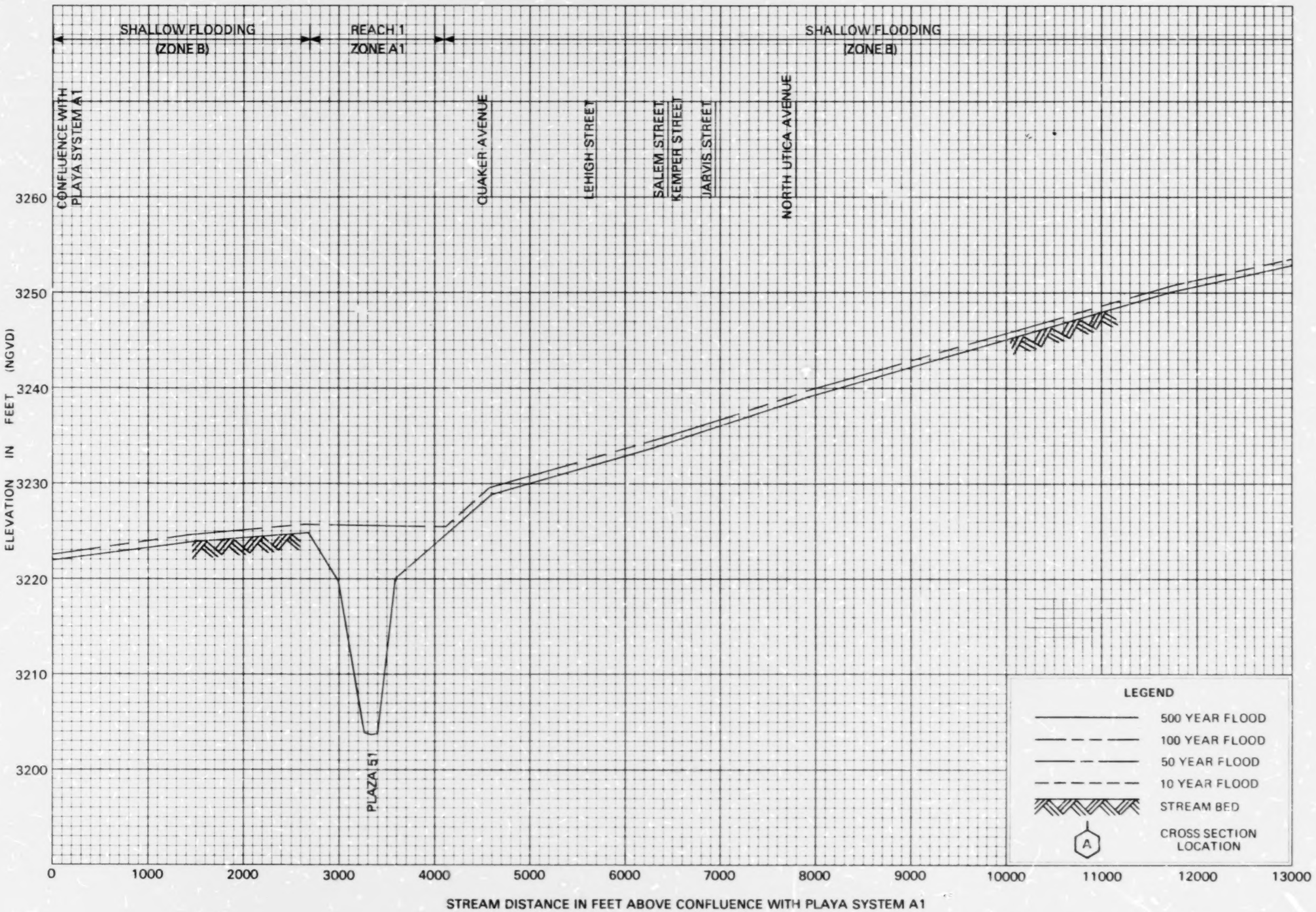

FLOOD PROFILES

PLAYA SYSTEM B

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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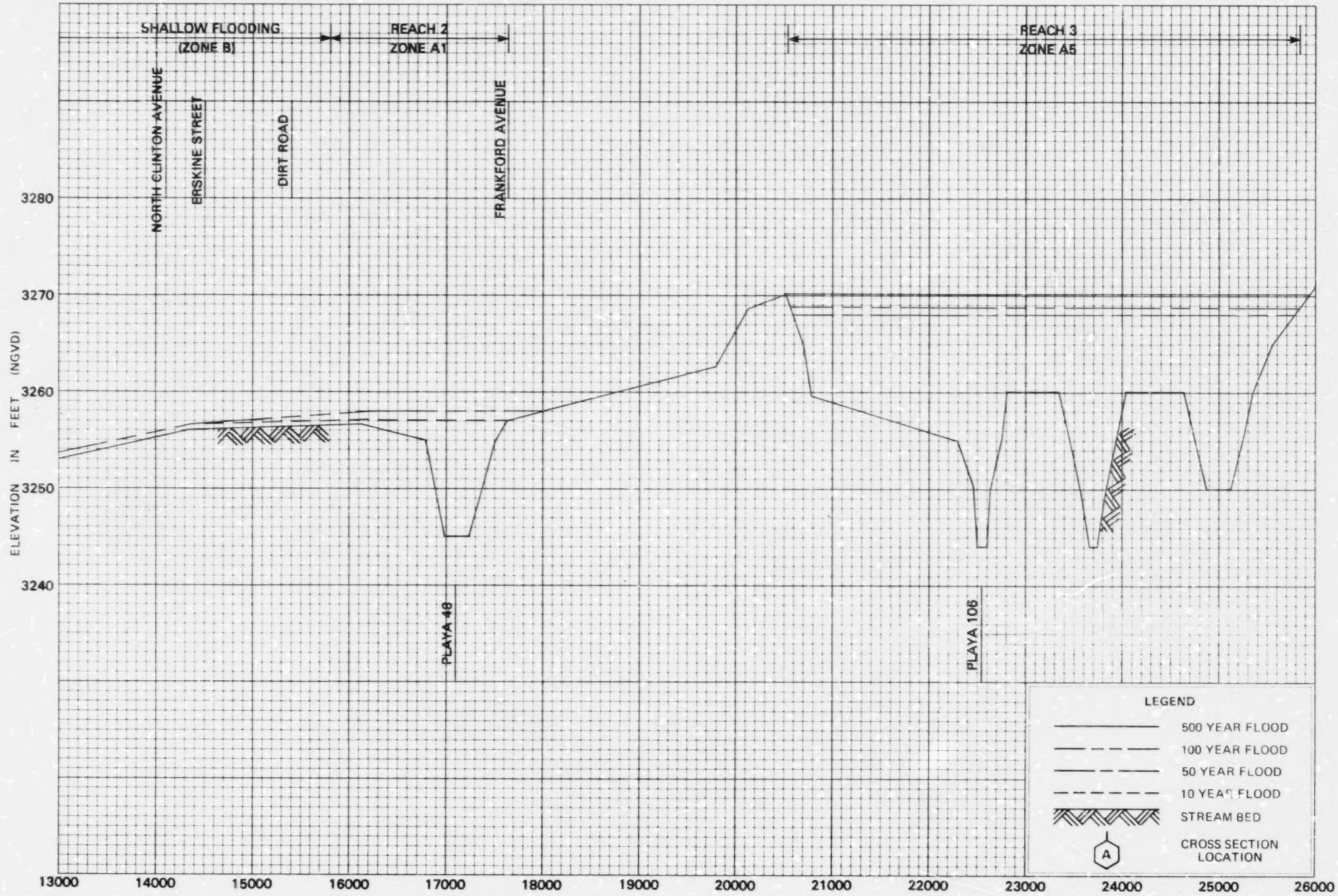

FLOOD PROFILES

PLAYA SYSTEM B

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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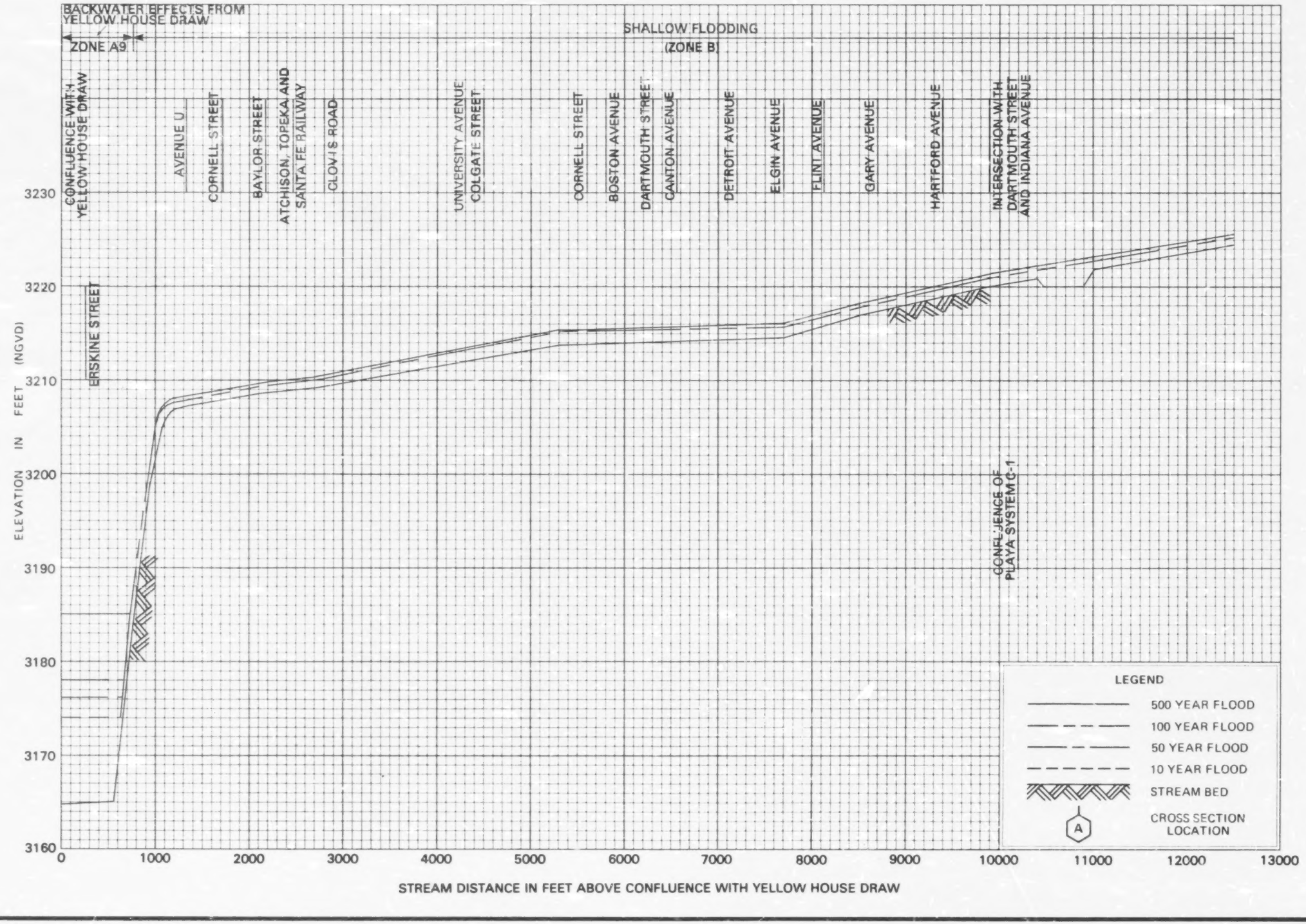

FLOOD PROFILES

PLAYA SYSTEM C

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

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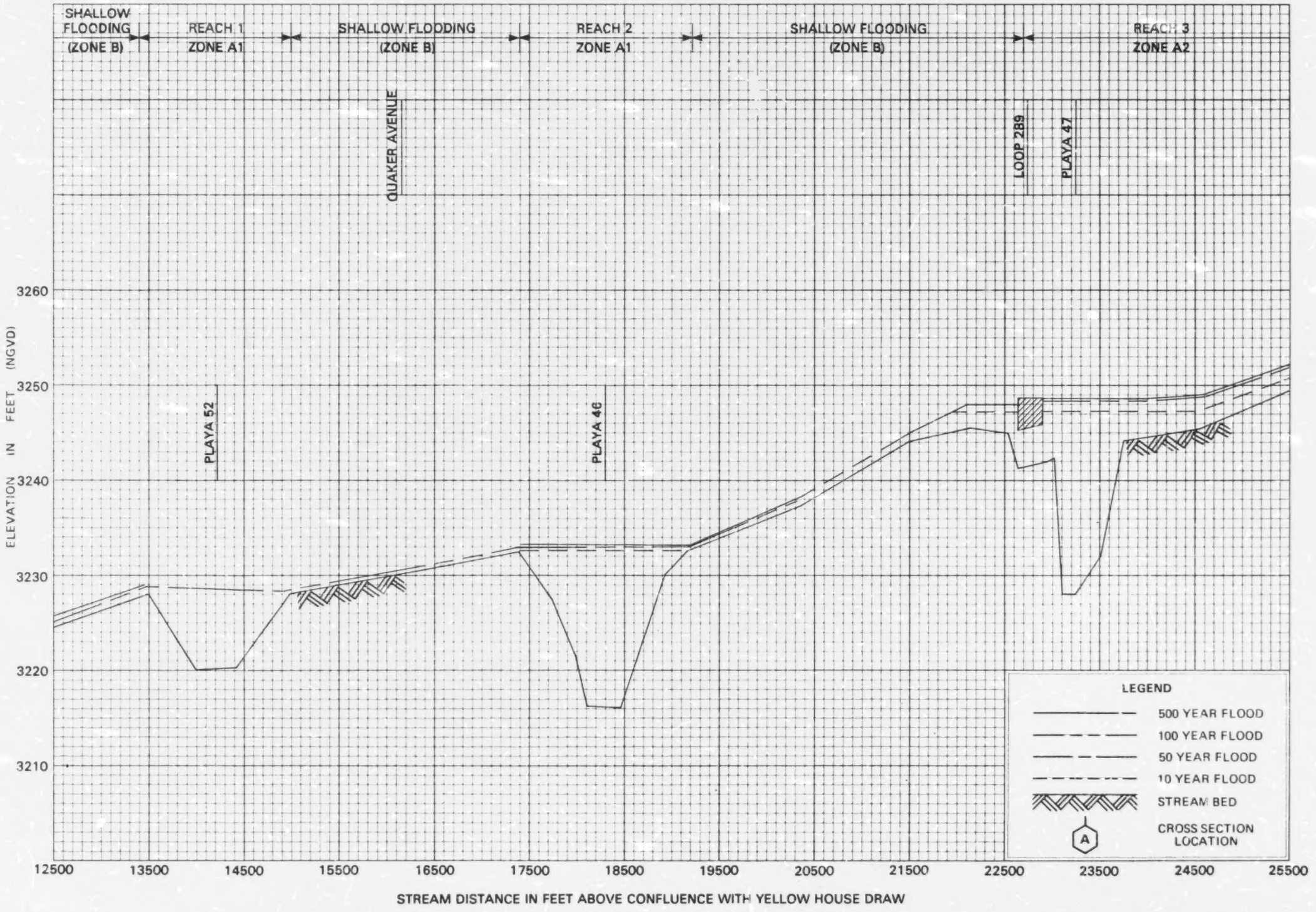

FLOOD PROFILES

PLAYA SYSTEM C

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

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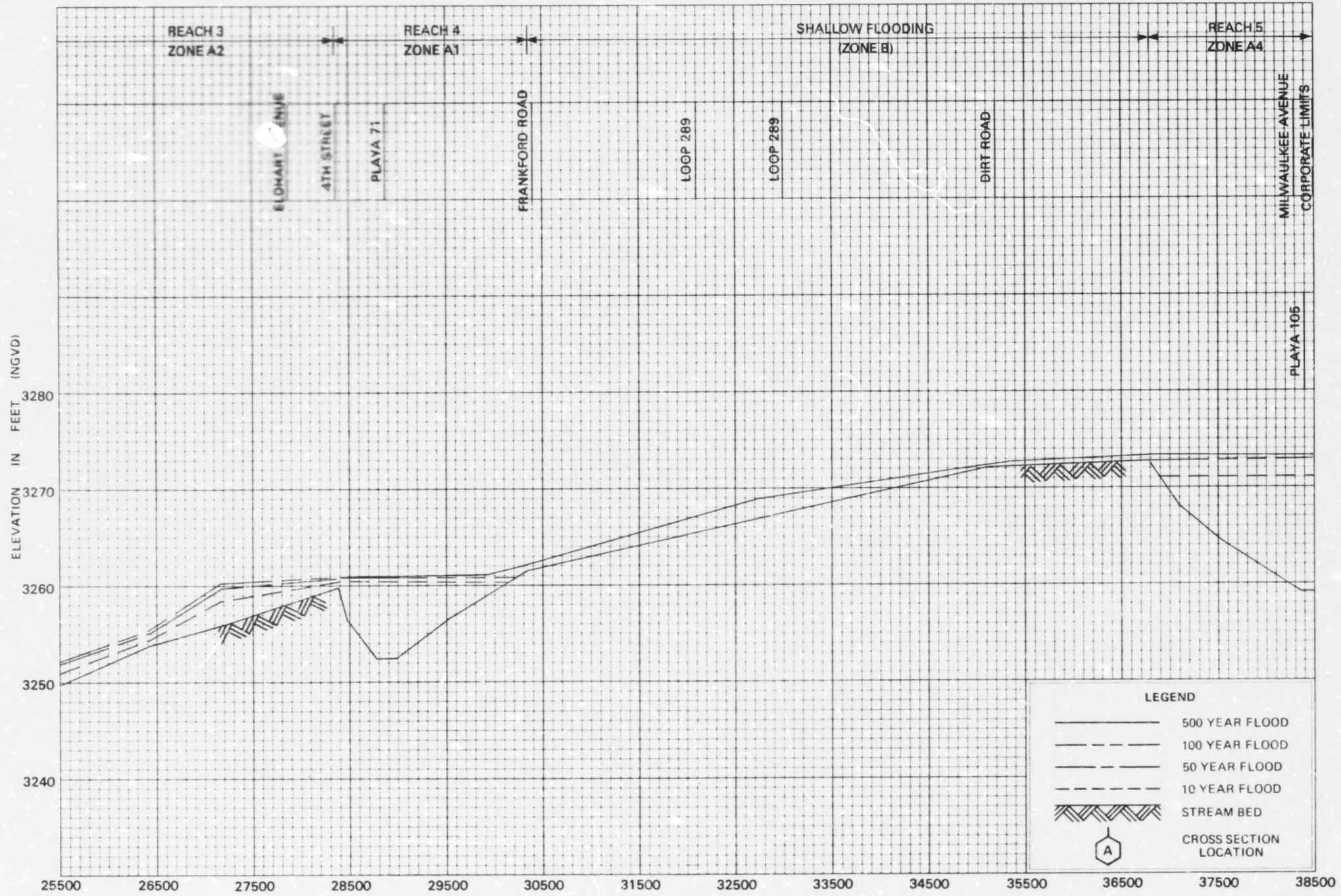

FLOOD PROFILES

PLAYA SYSTEM C

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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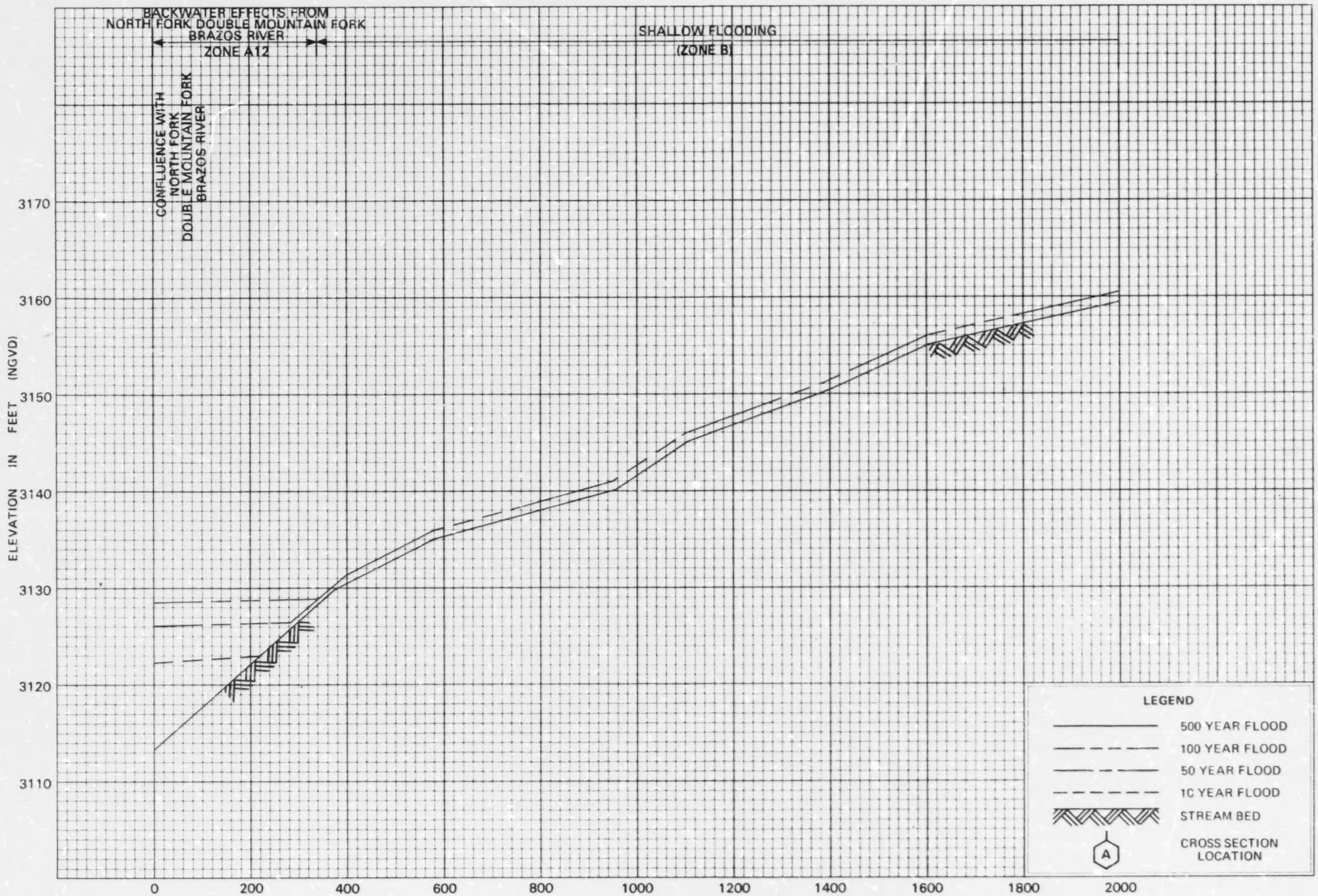

FLOOD PROFILES

PLAYA SYSTEM D1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

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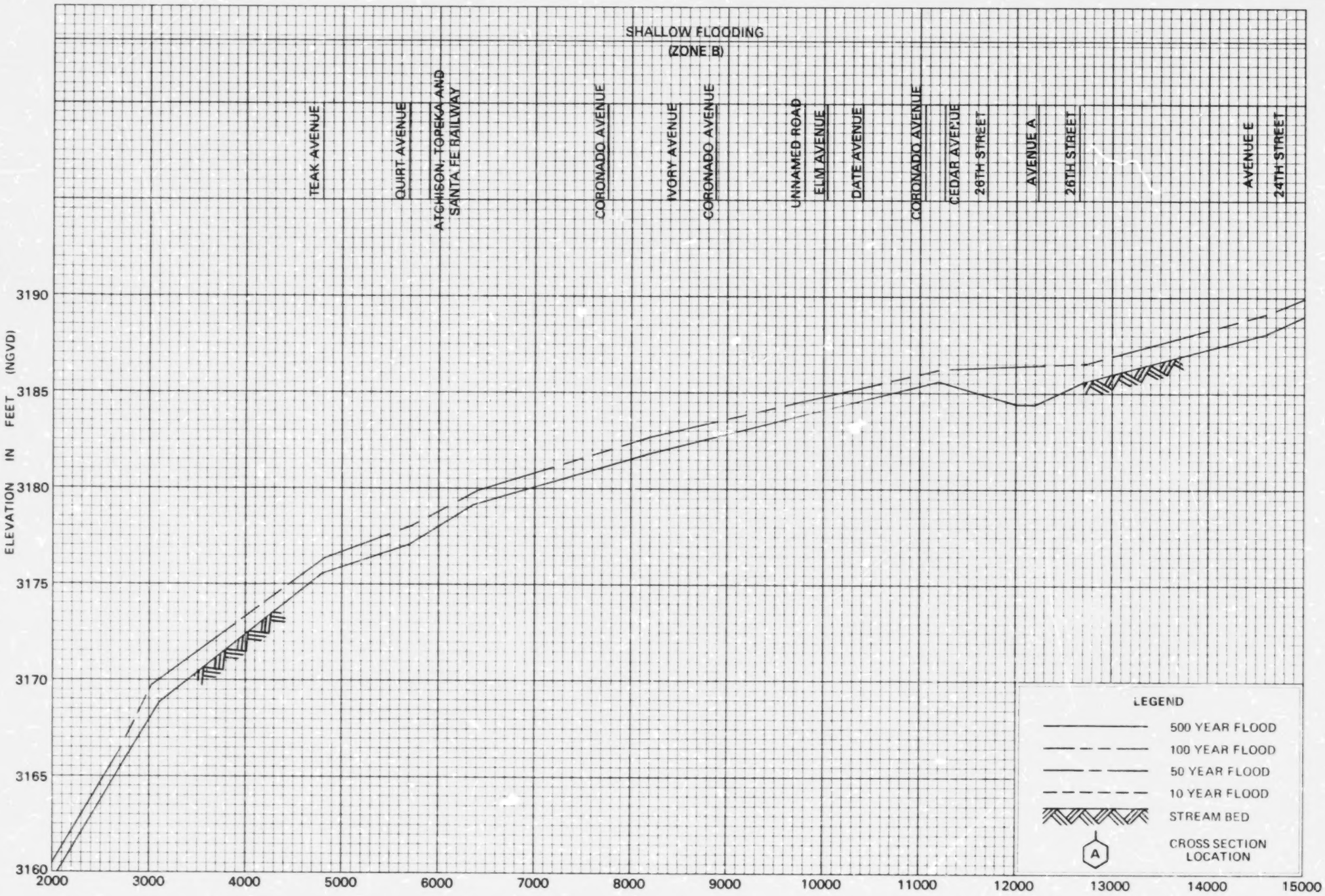

FLOOD PROFILES

PLAYA SYSTEM D1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

16P

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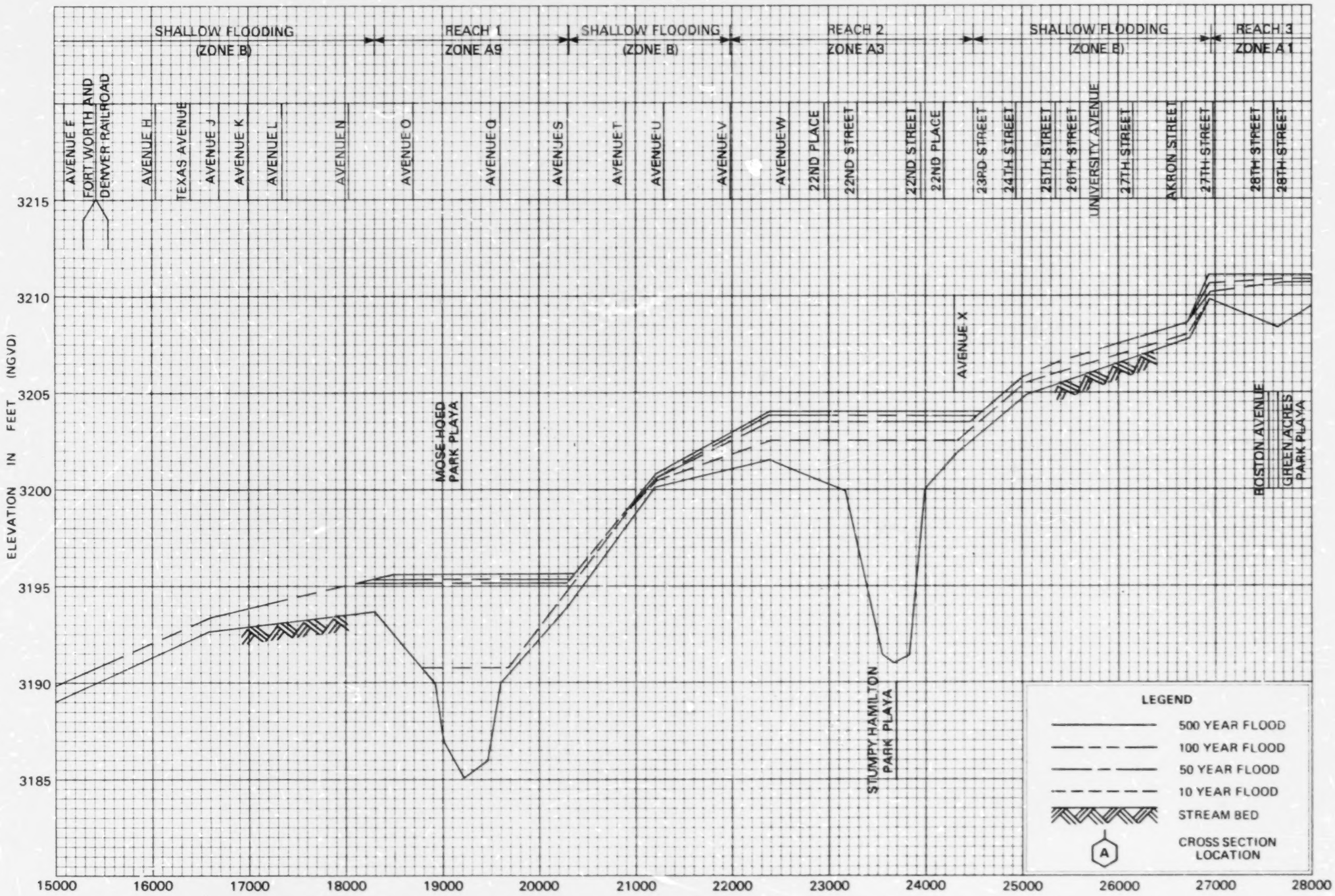

FLOOD PROFILES

PLAYA SYSTEM D1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

17P

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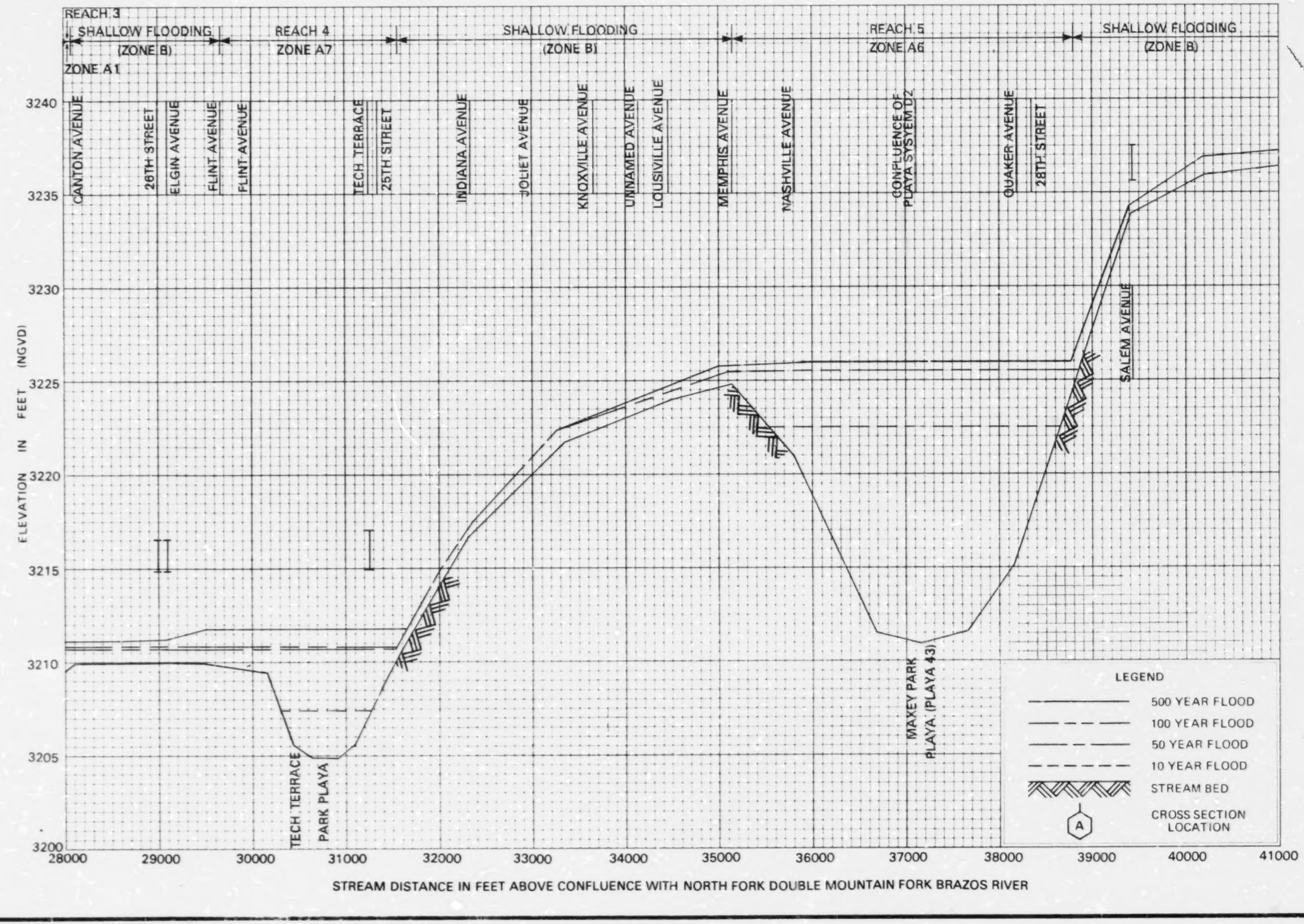


FLOOD PROFILES

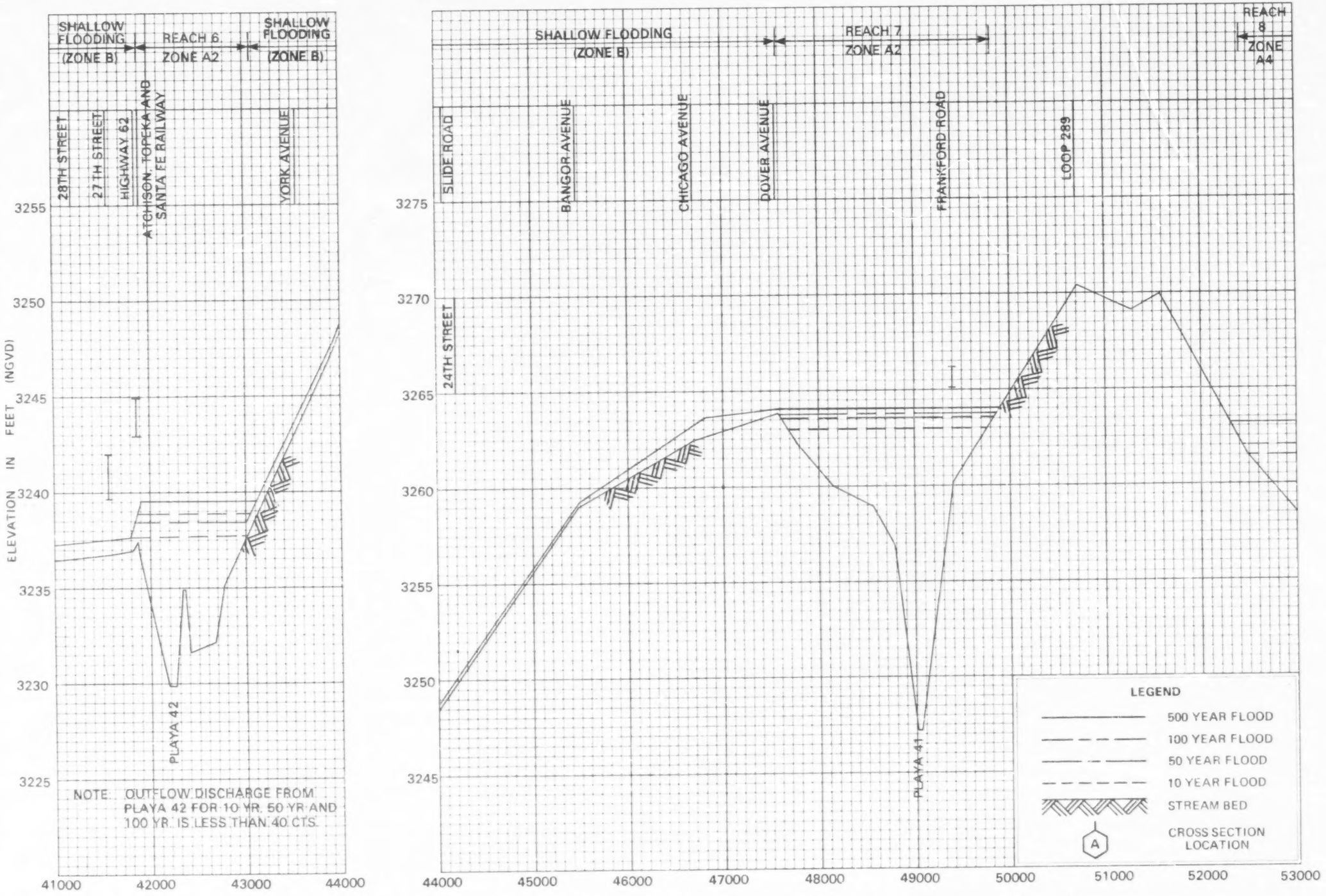
PLAYA SYSTEM D1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

18P

BEST COPY AVAILABLE



FLOOD PROFILES

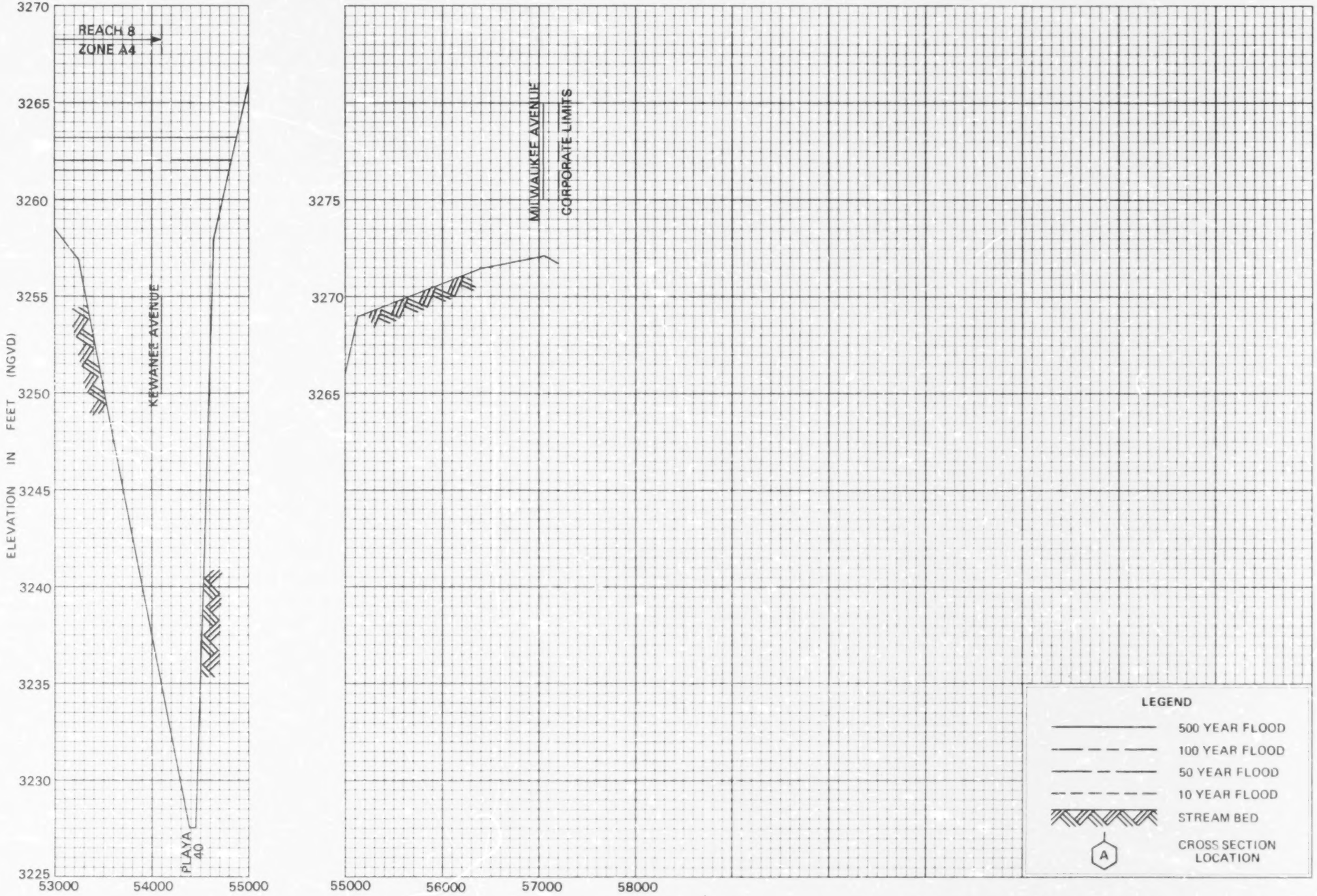
PLAYA SYSTEM D1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

19P

BEST COPY AVAILABLE



FLOOD PROFILES

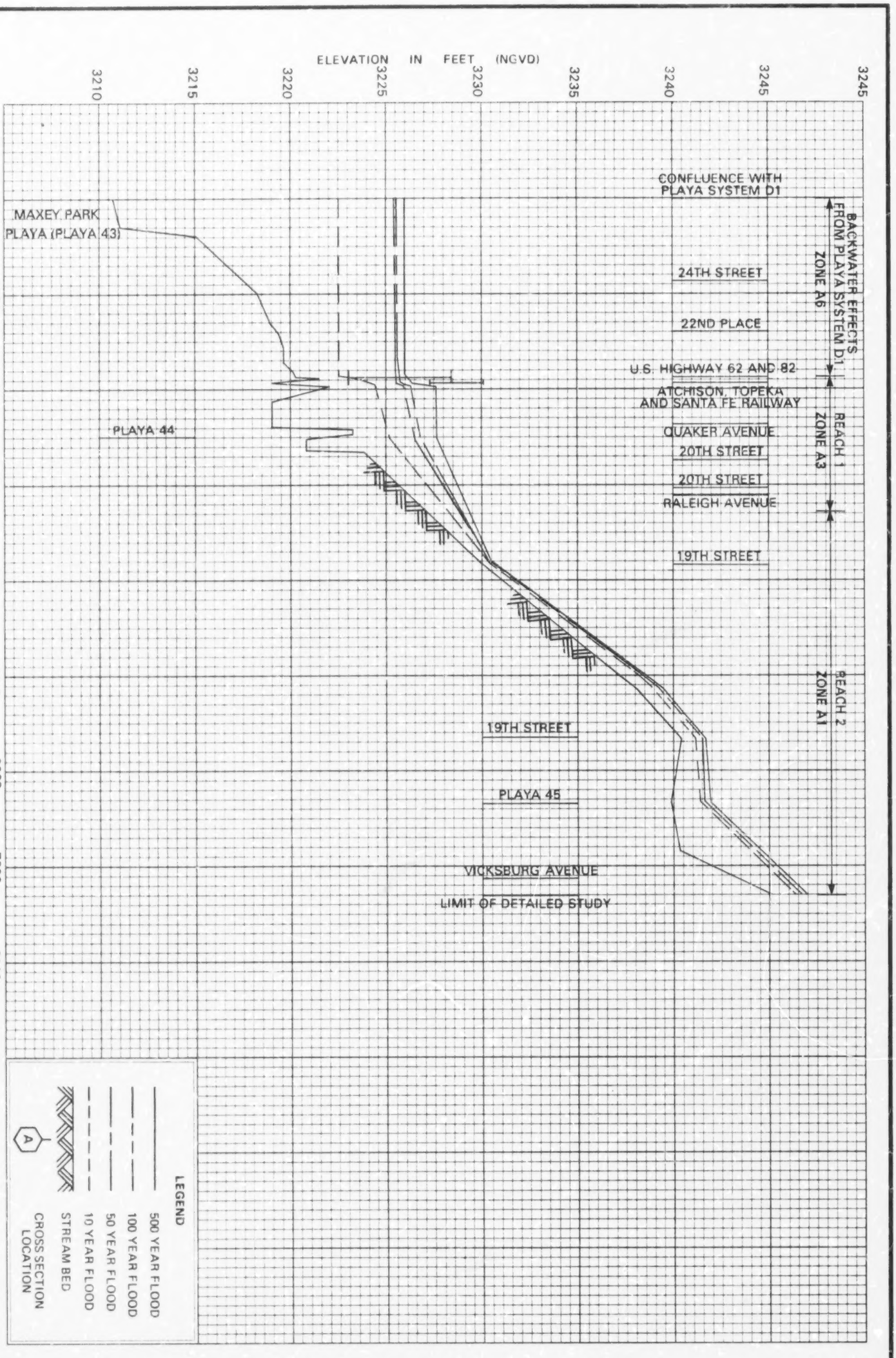
PLAYA SYSTEM D1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

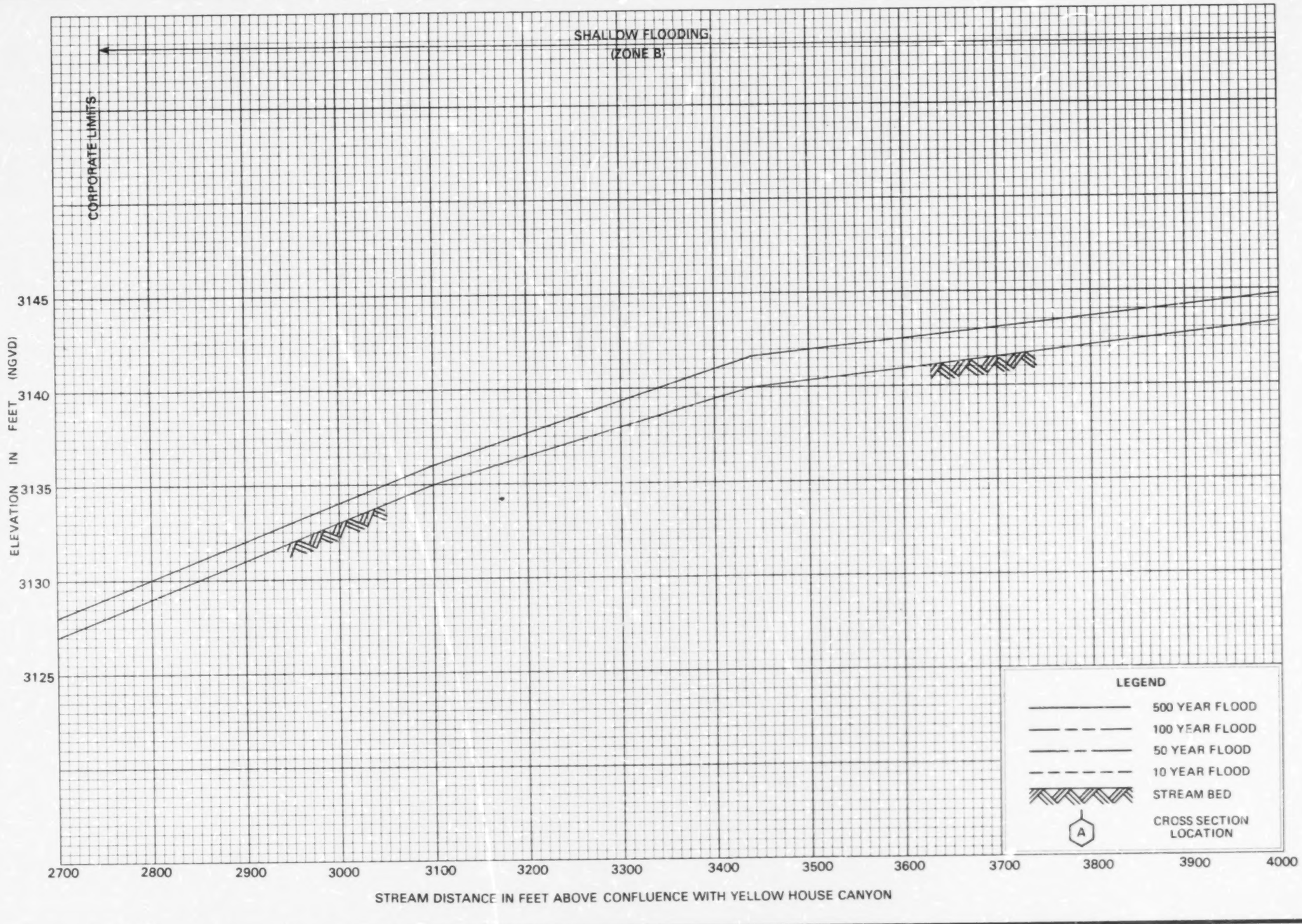
20P

BEST COPY AVAILABLE



21P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUBBOCK, TX (LUBBOCK CO.)	FLOOD PROFILES PLAYA SYSTEM D2

BEST COPY AVAILABLE



FLOOD PROFILES

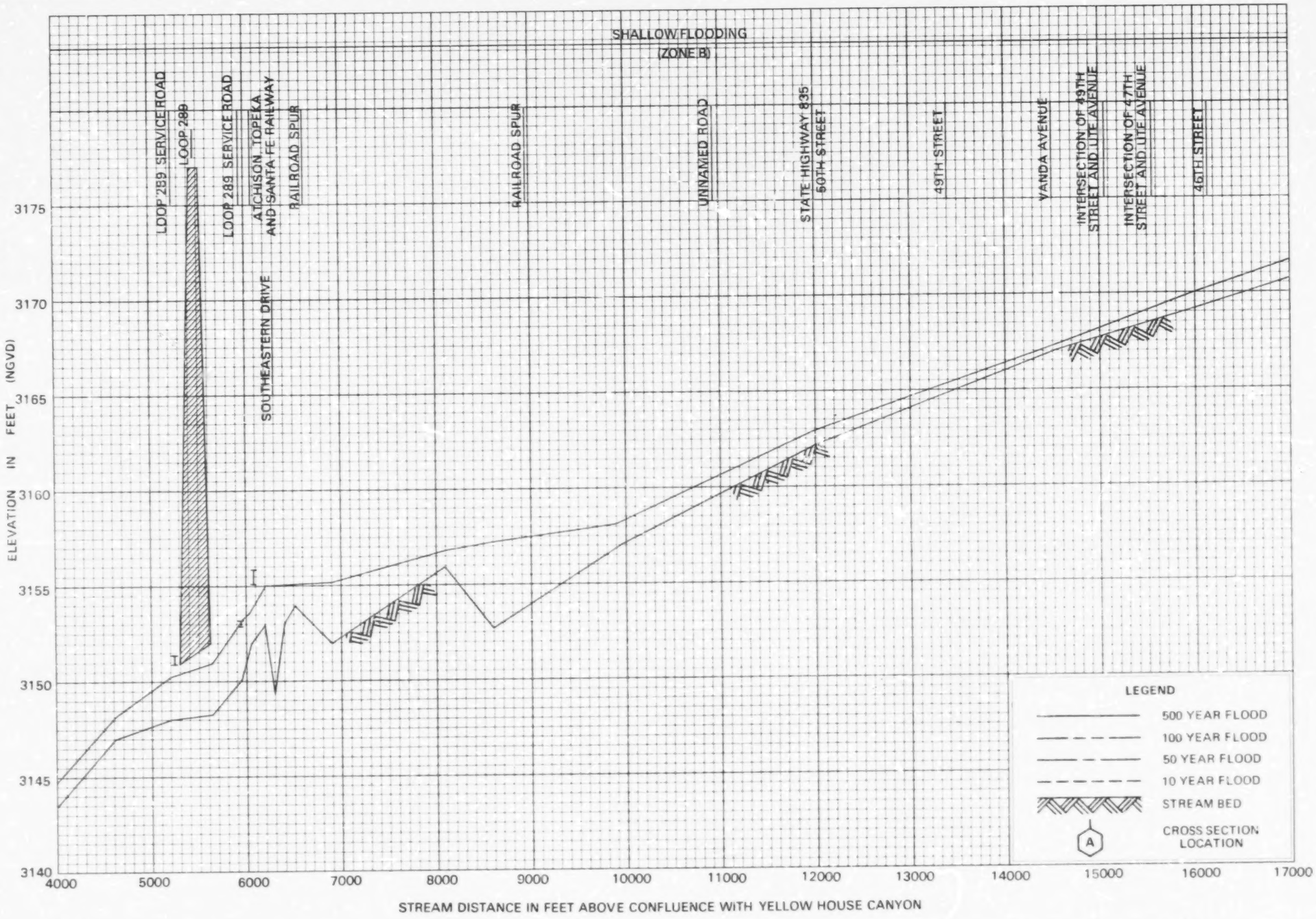
PLAYA SYSTEM E1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

22P

BEST COPY AVAILABLE



FLOOD PROFILES

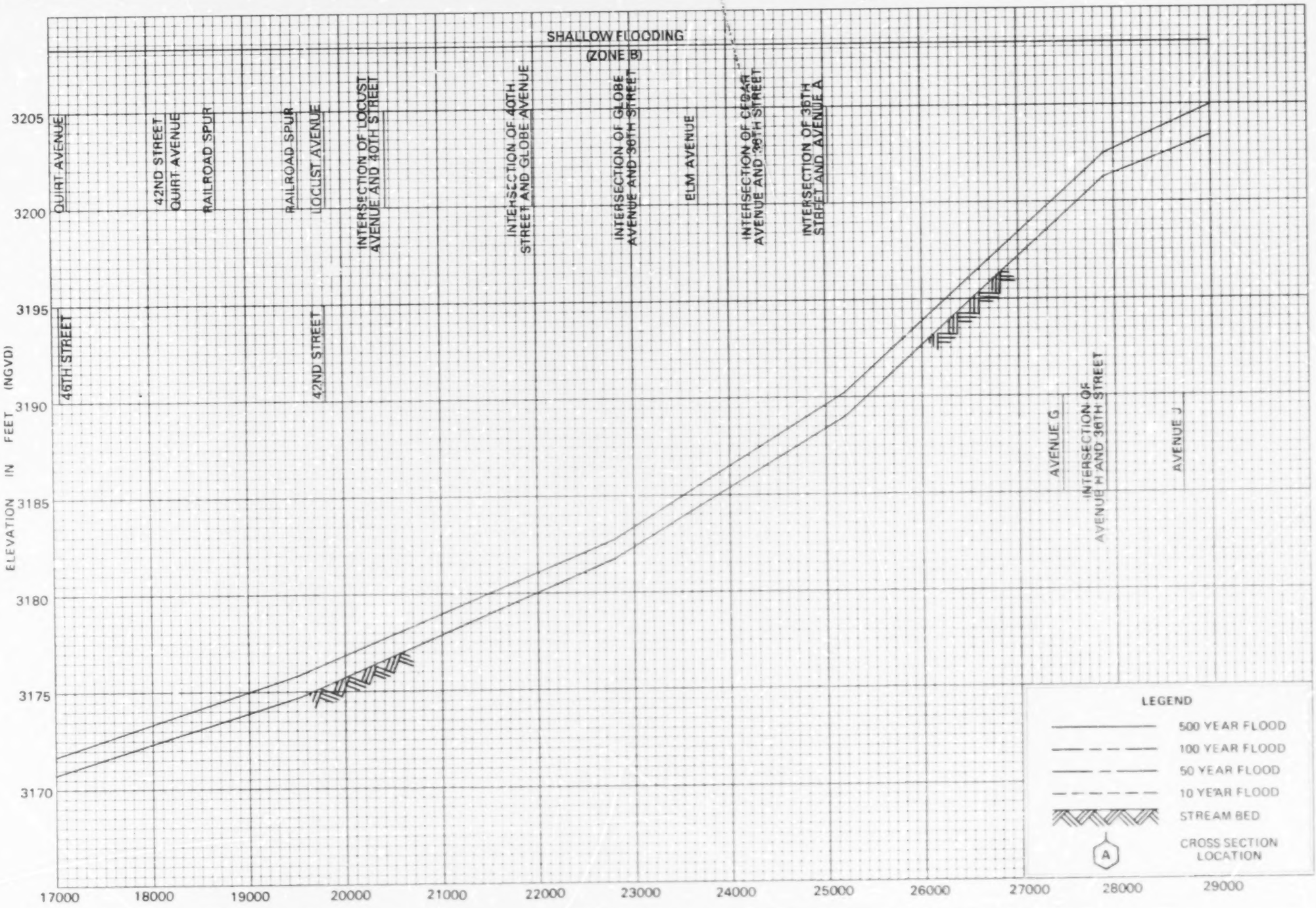
PLAYA SYSTEM E1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

23P

BEST COPY AVAILABLE



FLOOD PROFILES

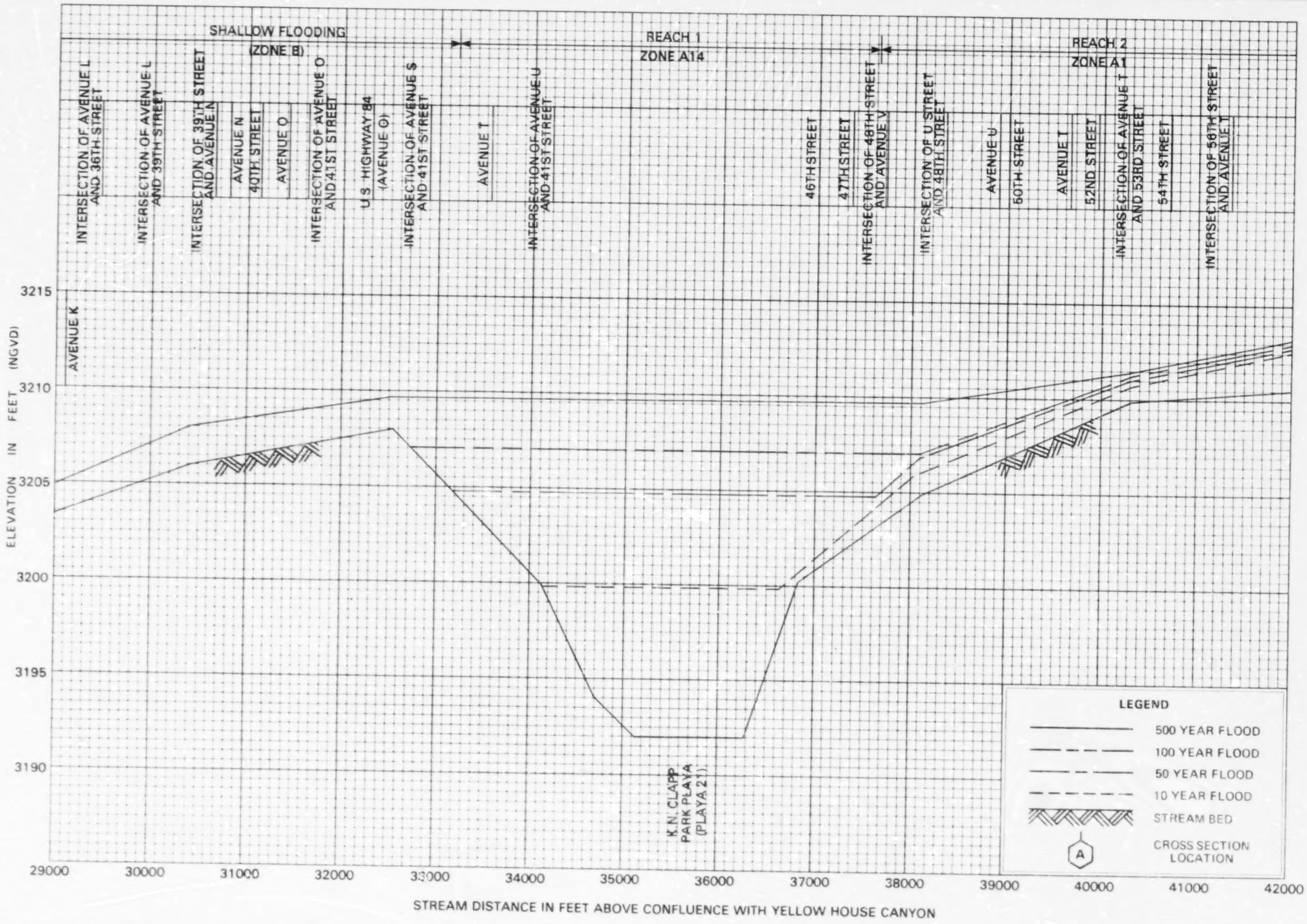
PLAYA SYSTEM E1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

24P

BEST COPY AVAILABLE



FLOOD PROFILES

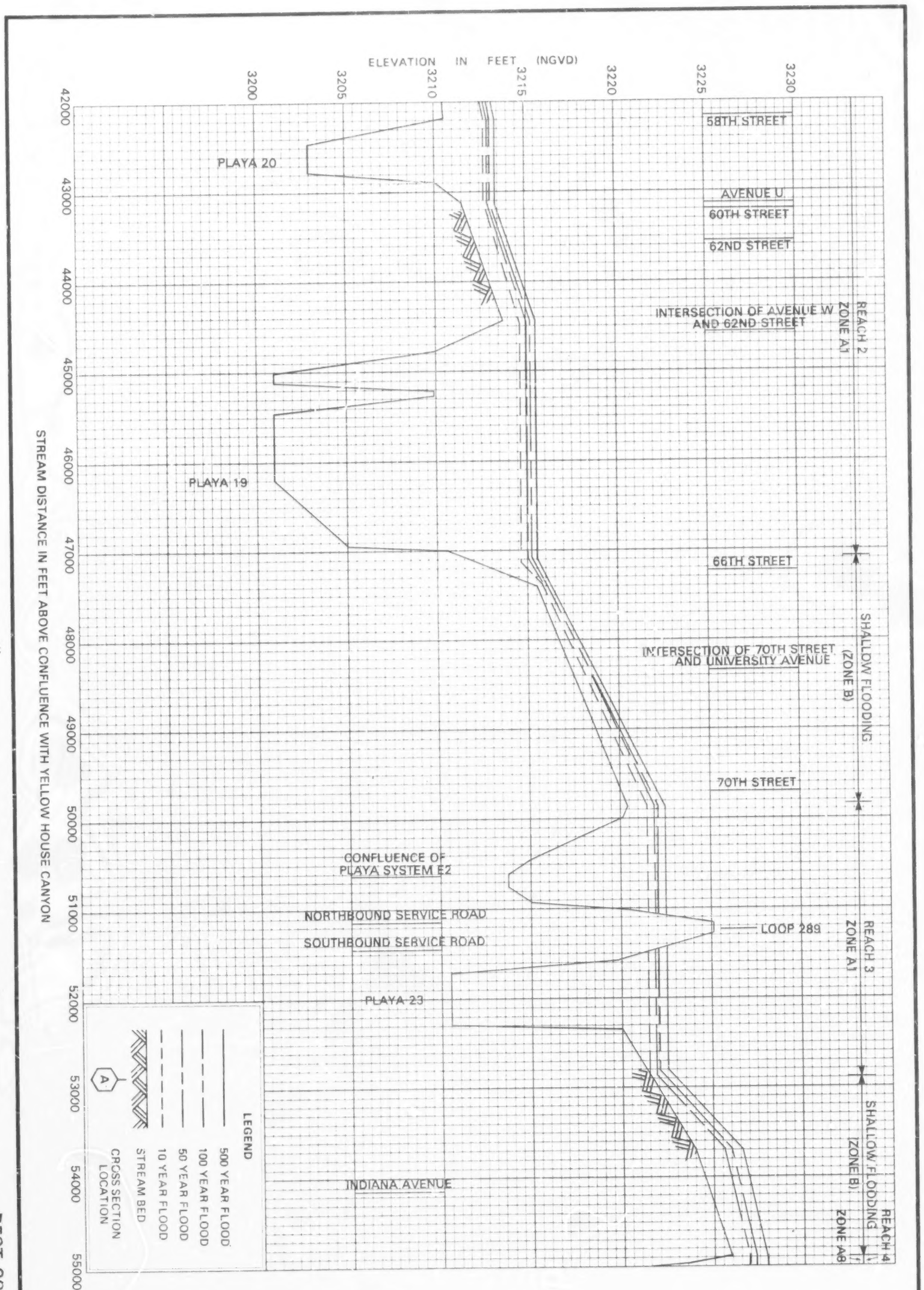
PLAYA SYSTEM E1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

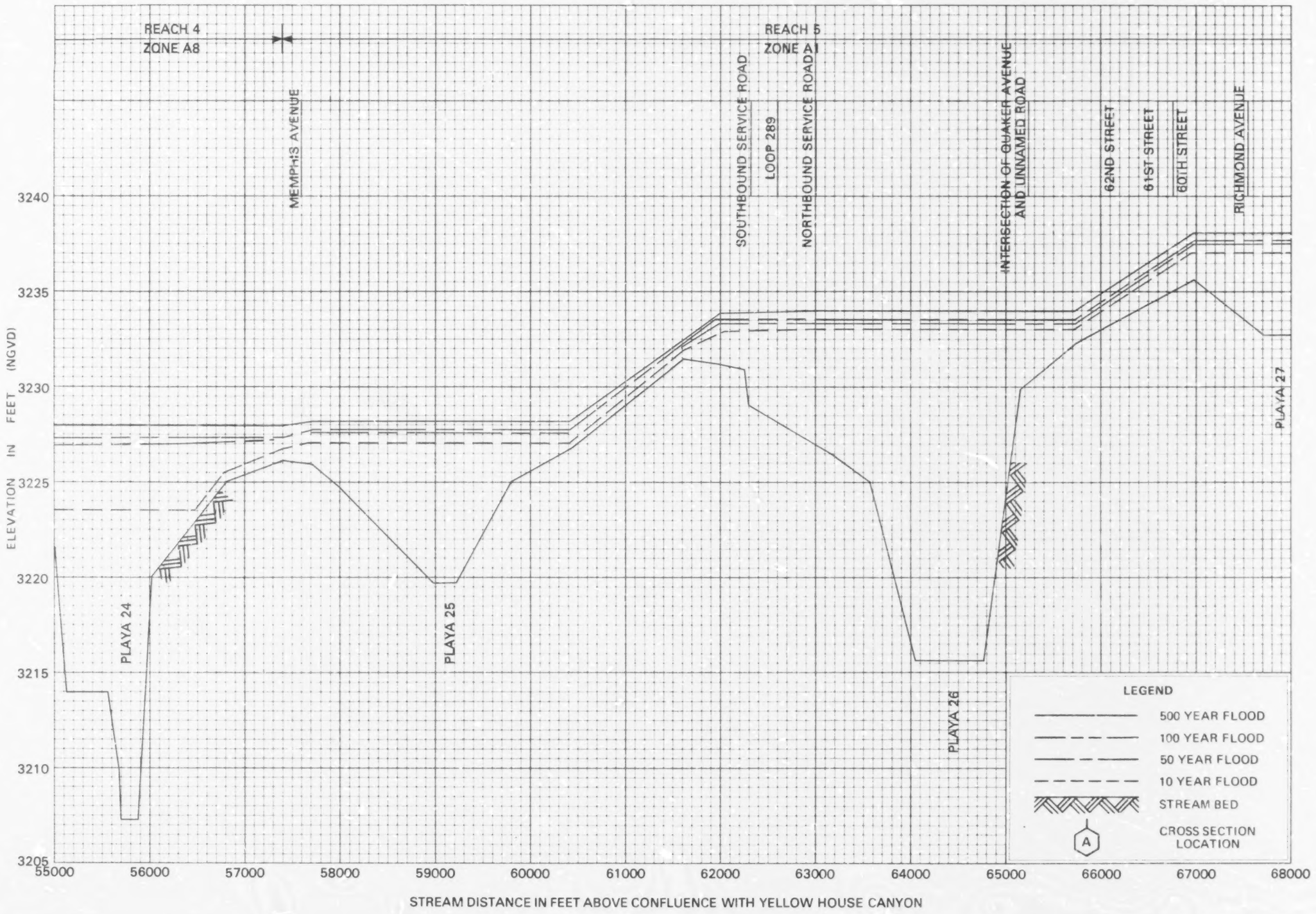
25P

BEST COPY AVAILABLE



26P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUBBOCK, TX (LUBBOCK CO.)	FLOOD PROFILES PLAYA SYSTEM E1

BEST COPY AVAILABLE



FLOOD PROFILES

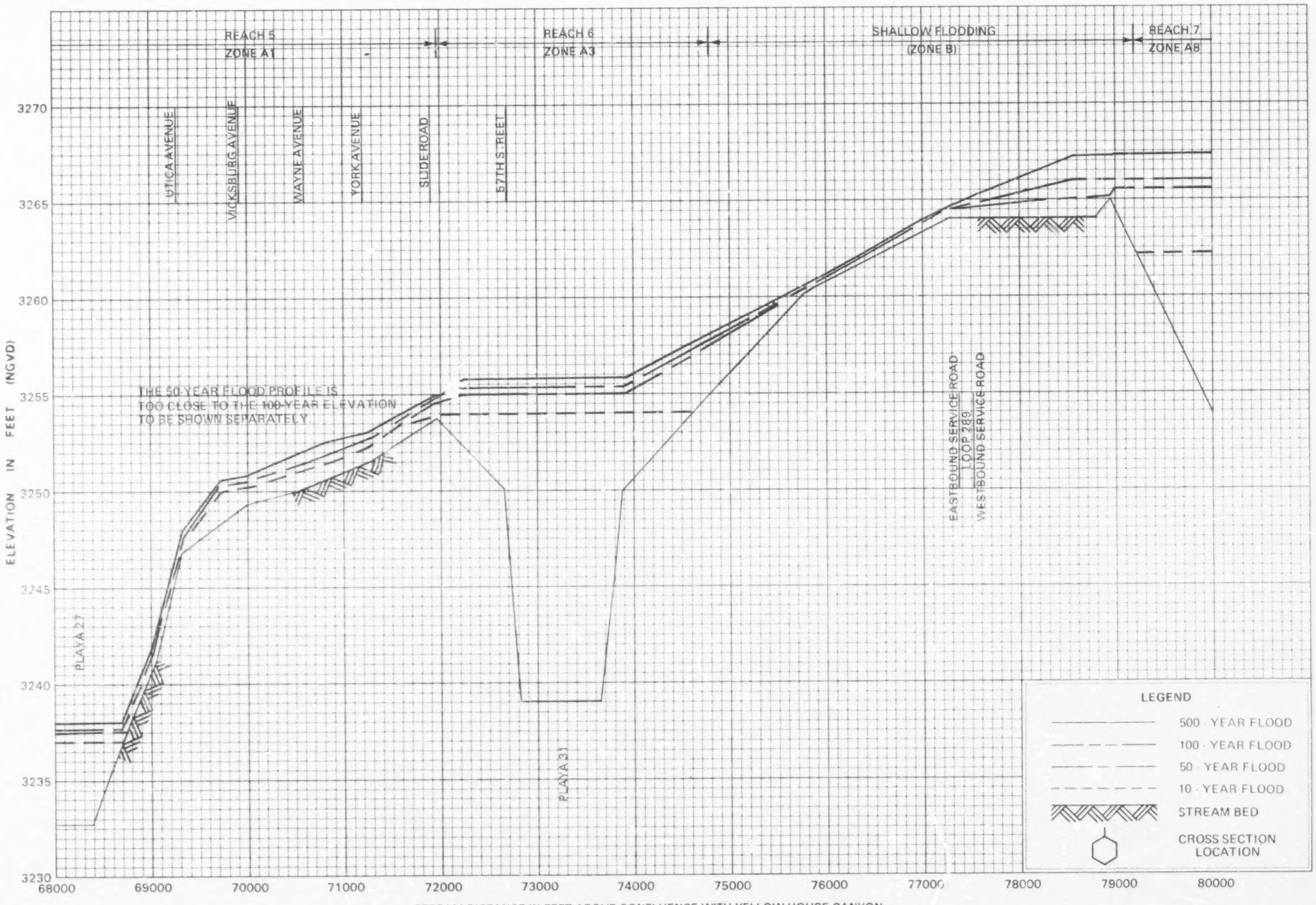
PLAYA SYSTEM E1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

27P

BEST COPY AVAILABLE



FLOOD PROFILES

PLAYA SYSTEM E1

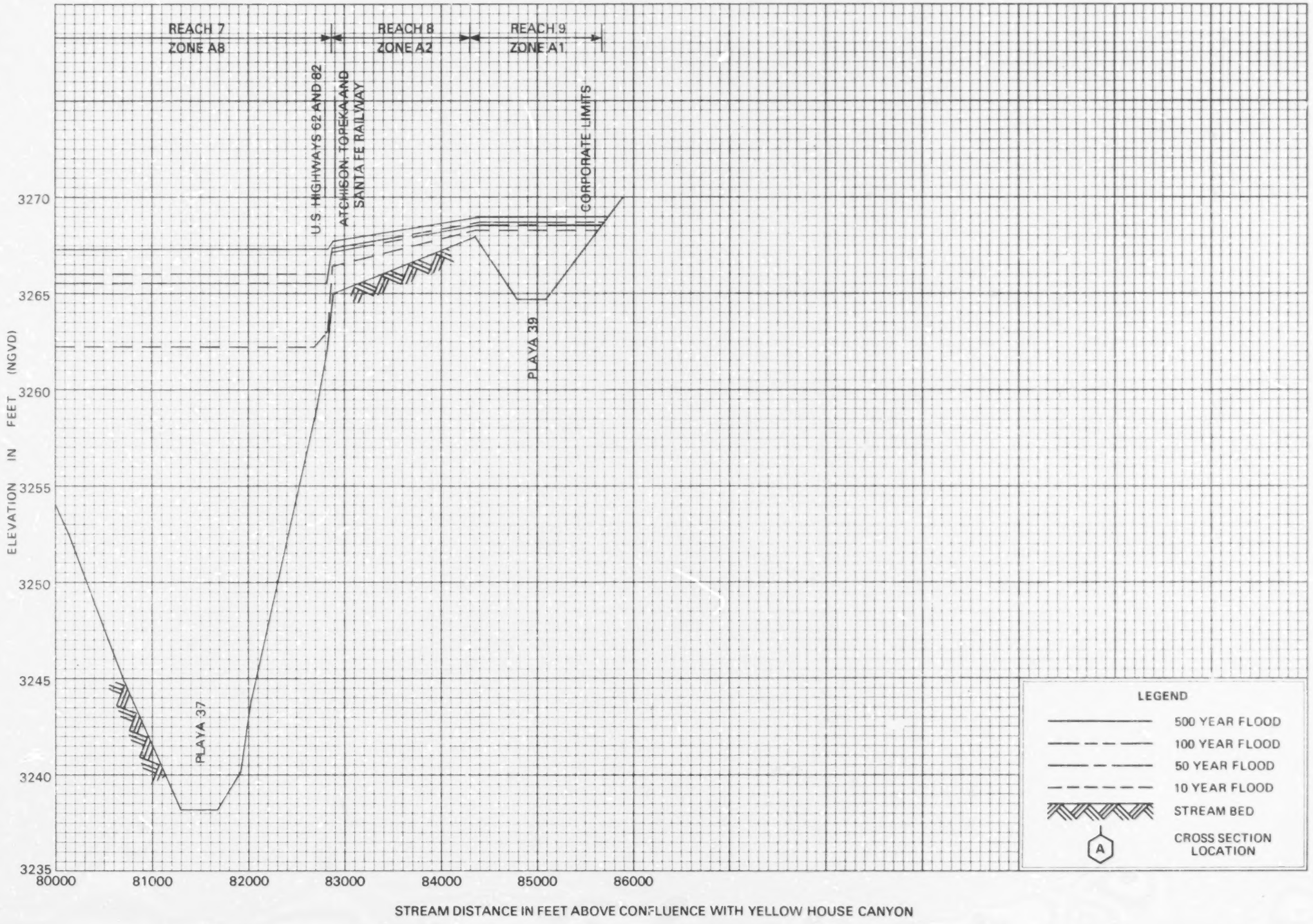
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX

(LUBBOCK CO.)

28P

BEST COPY AVAILABLE



FLOOD PROFILES

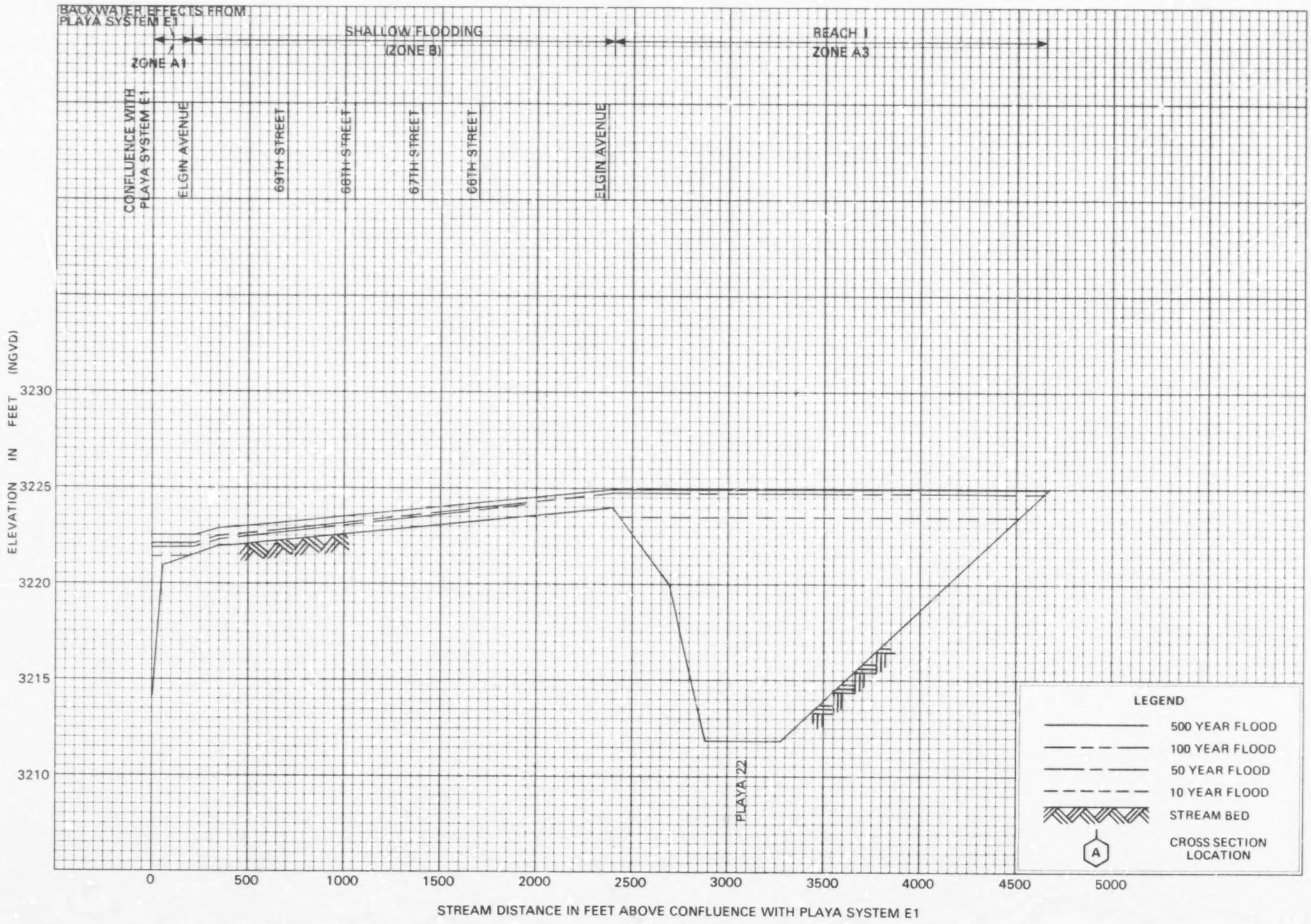
PLAYA SYSTEM E1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

29P

BEST COPY AVAILABLE



FLOOD PROFILES

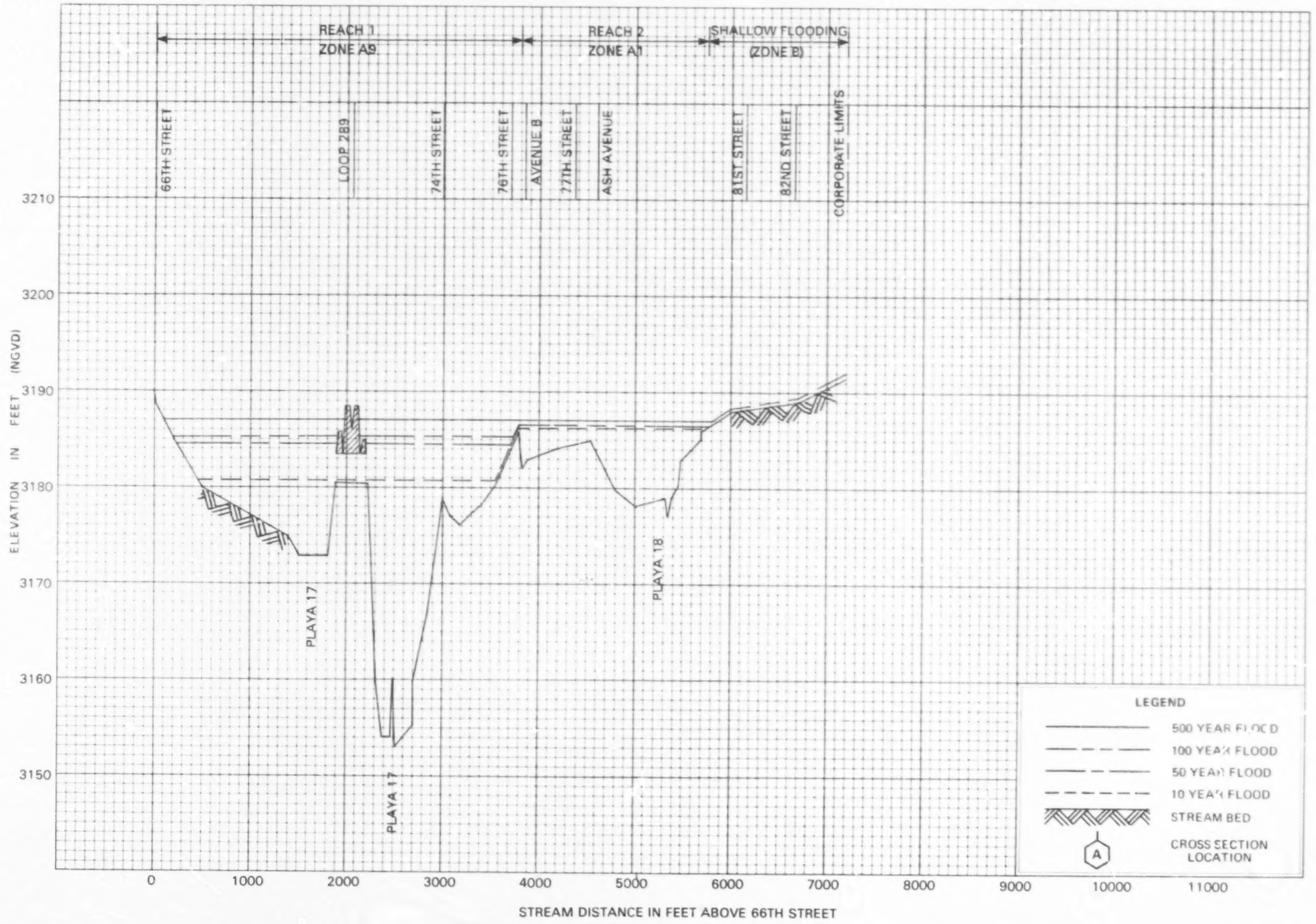
PLAYA SYSTEM E2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

30P

BEST COPY AVAILABLE



FLOOD PROFILES

PLAYA SYSTEM F

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

31P

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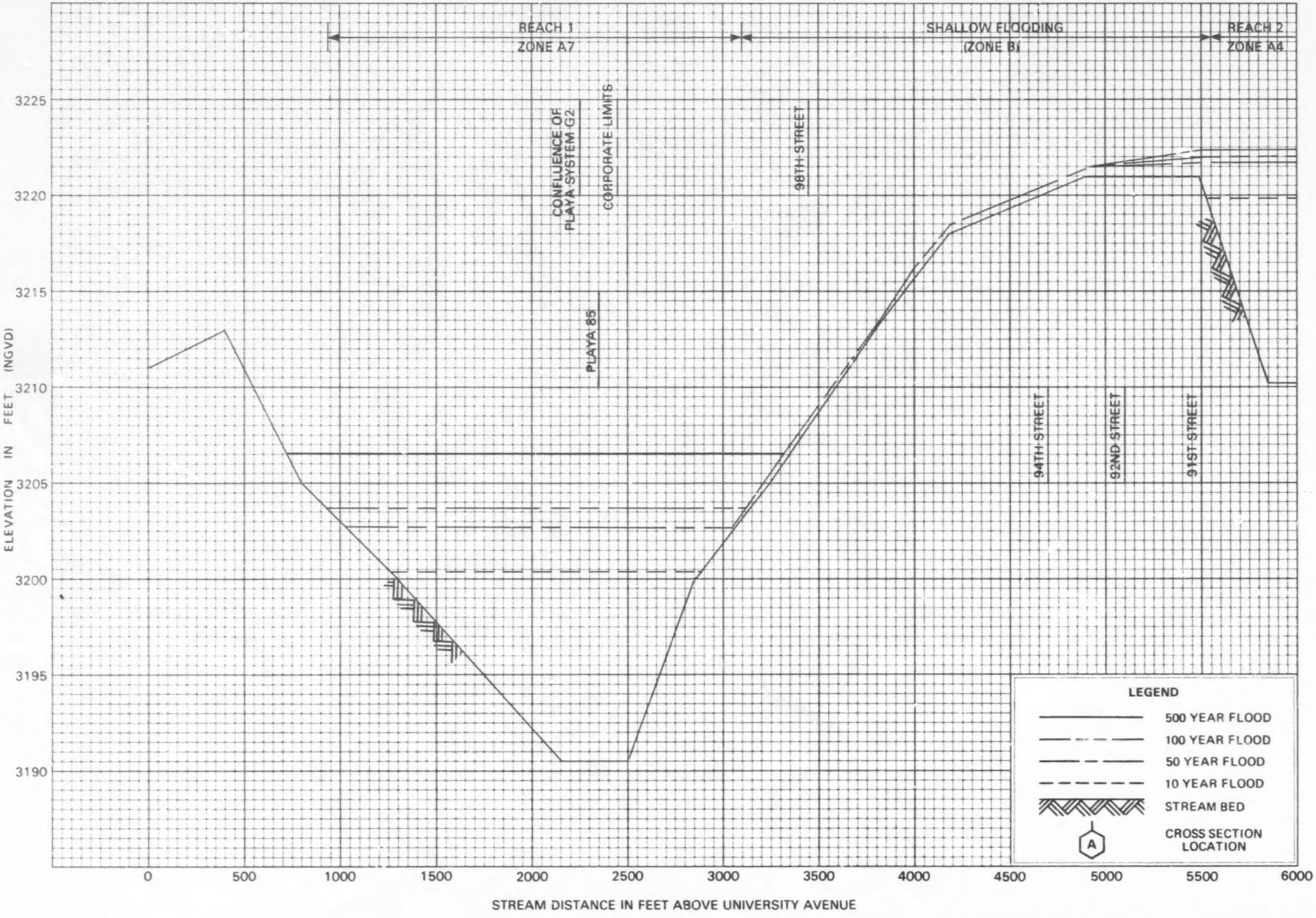

FLOOD PROFILES

PLAYA SYSTEM G1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

32P

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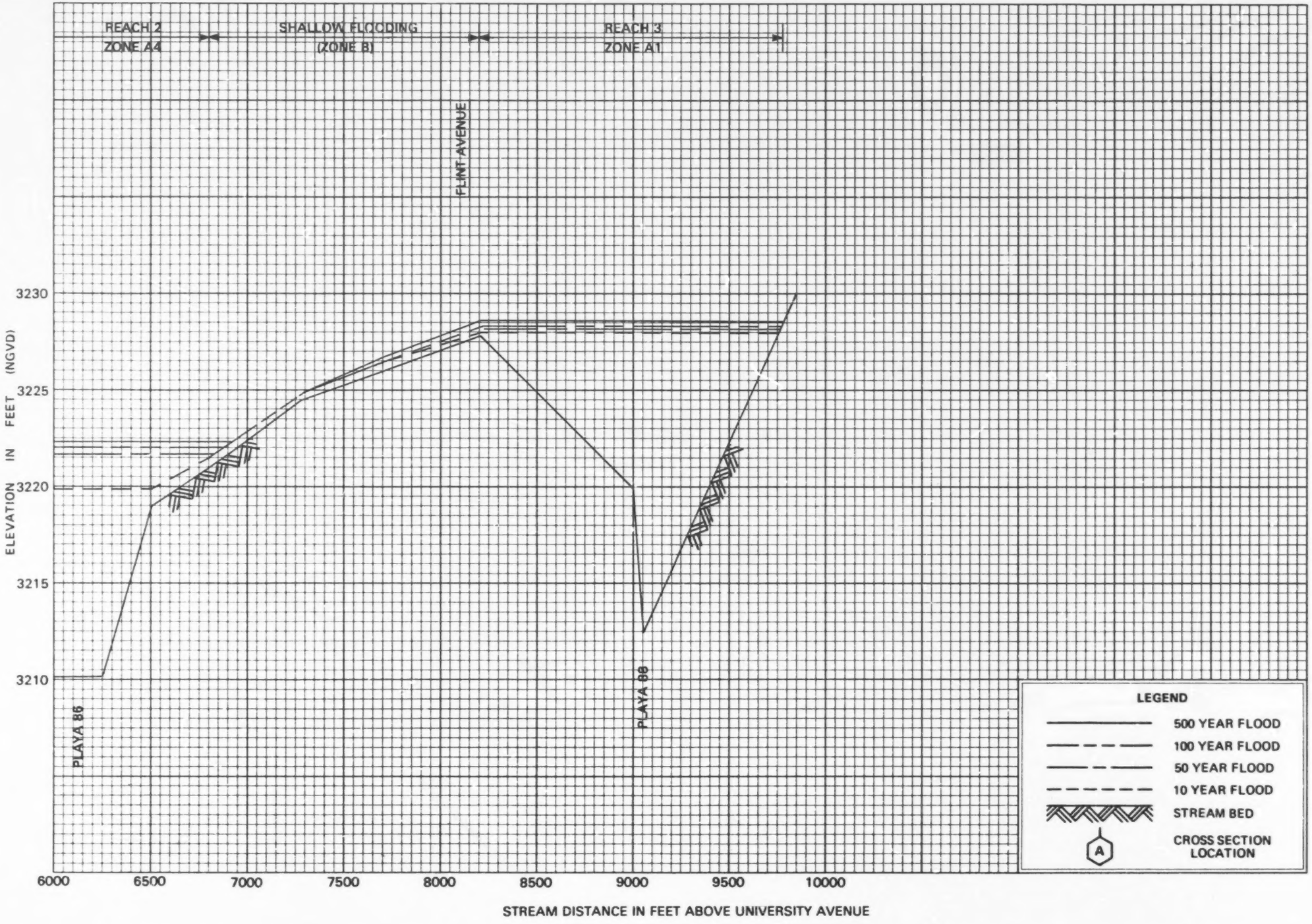

FLOOD PROFILES

PLAYA SYSTEM G1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

33P

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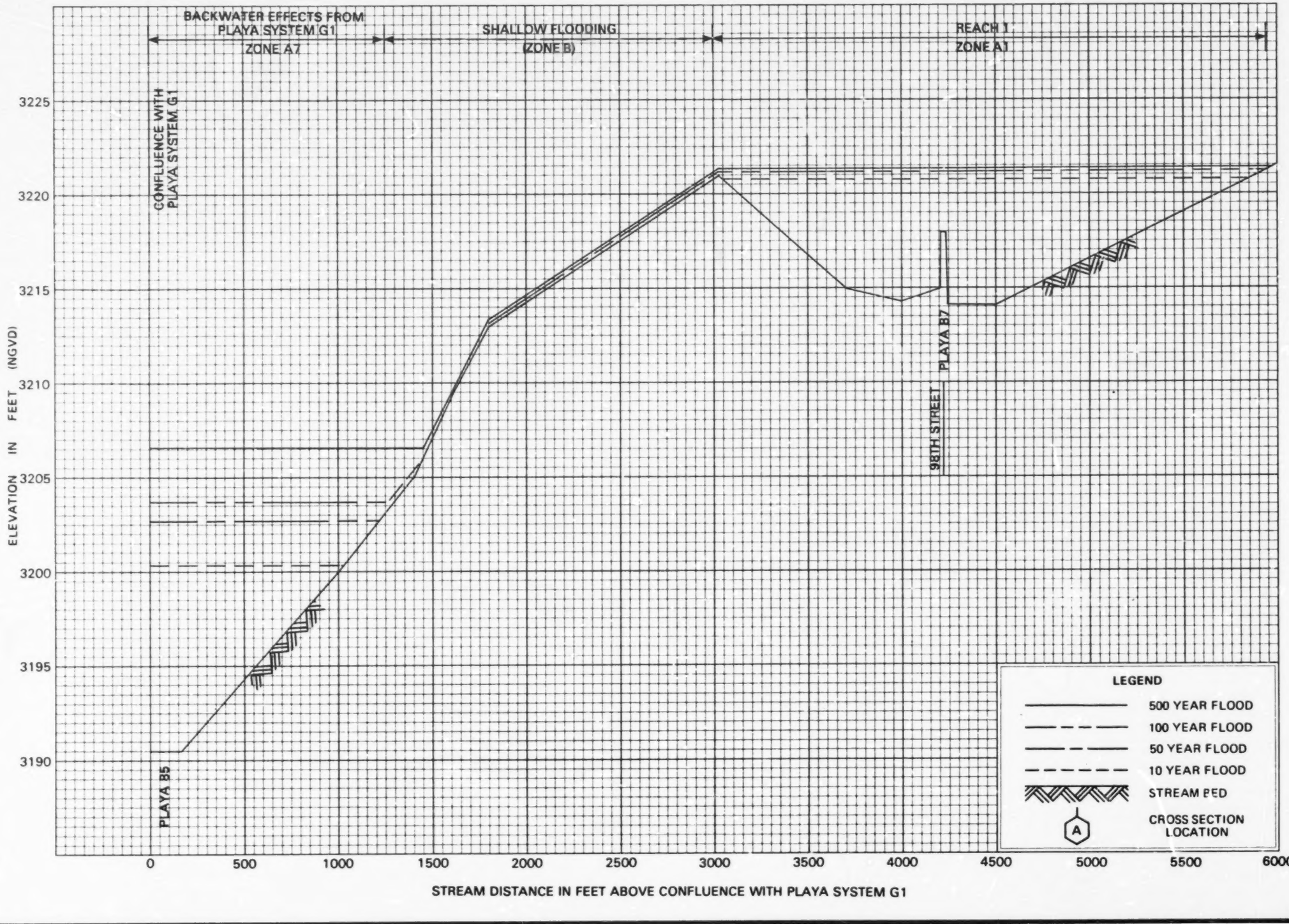

FLOOD PROFILES

PLAYA SYSTEM G2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

34P

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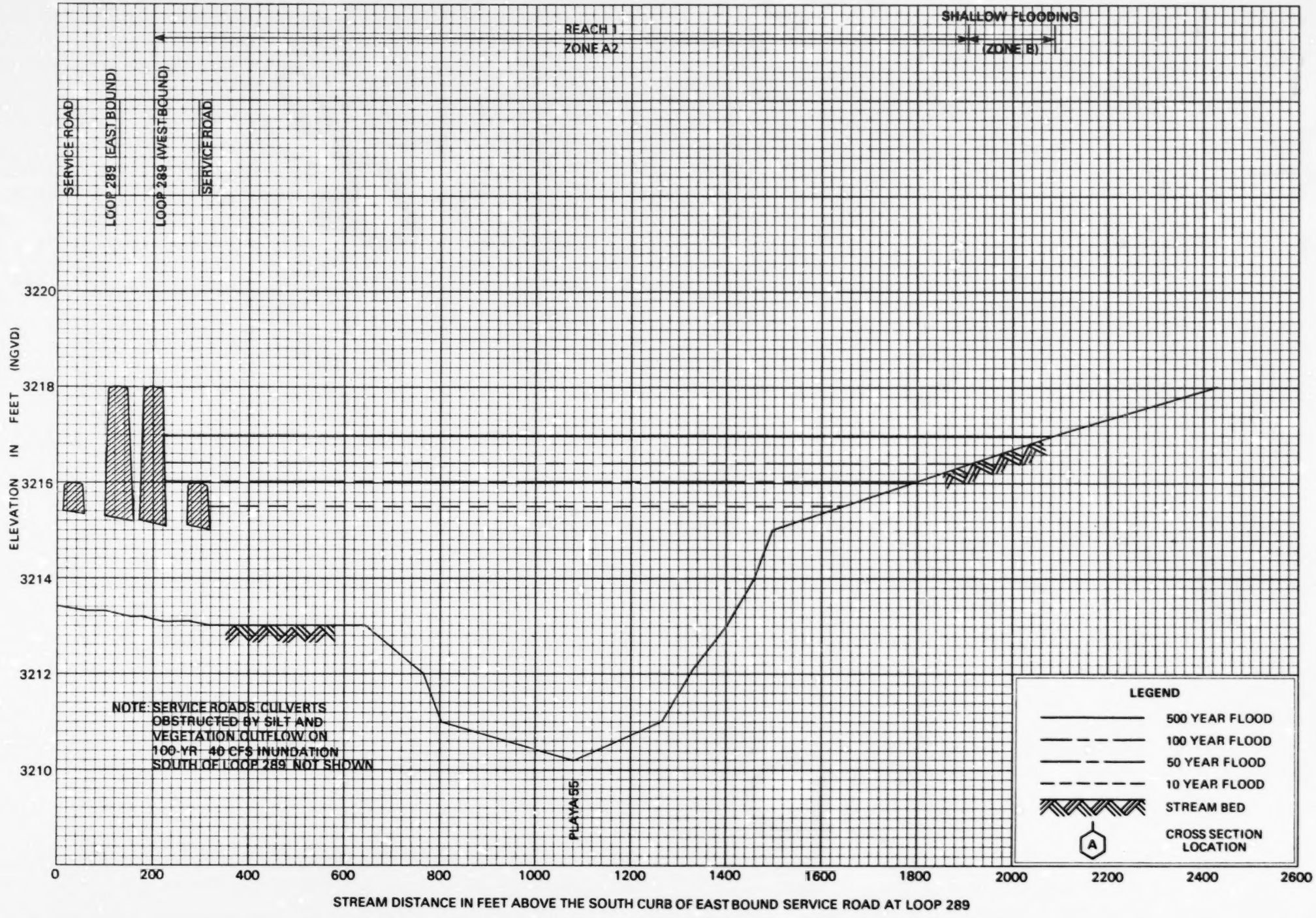

FLOOD PROFILES

PLAYA SYSTEM H

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

35P

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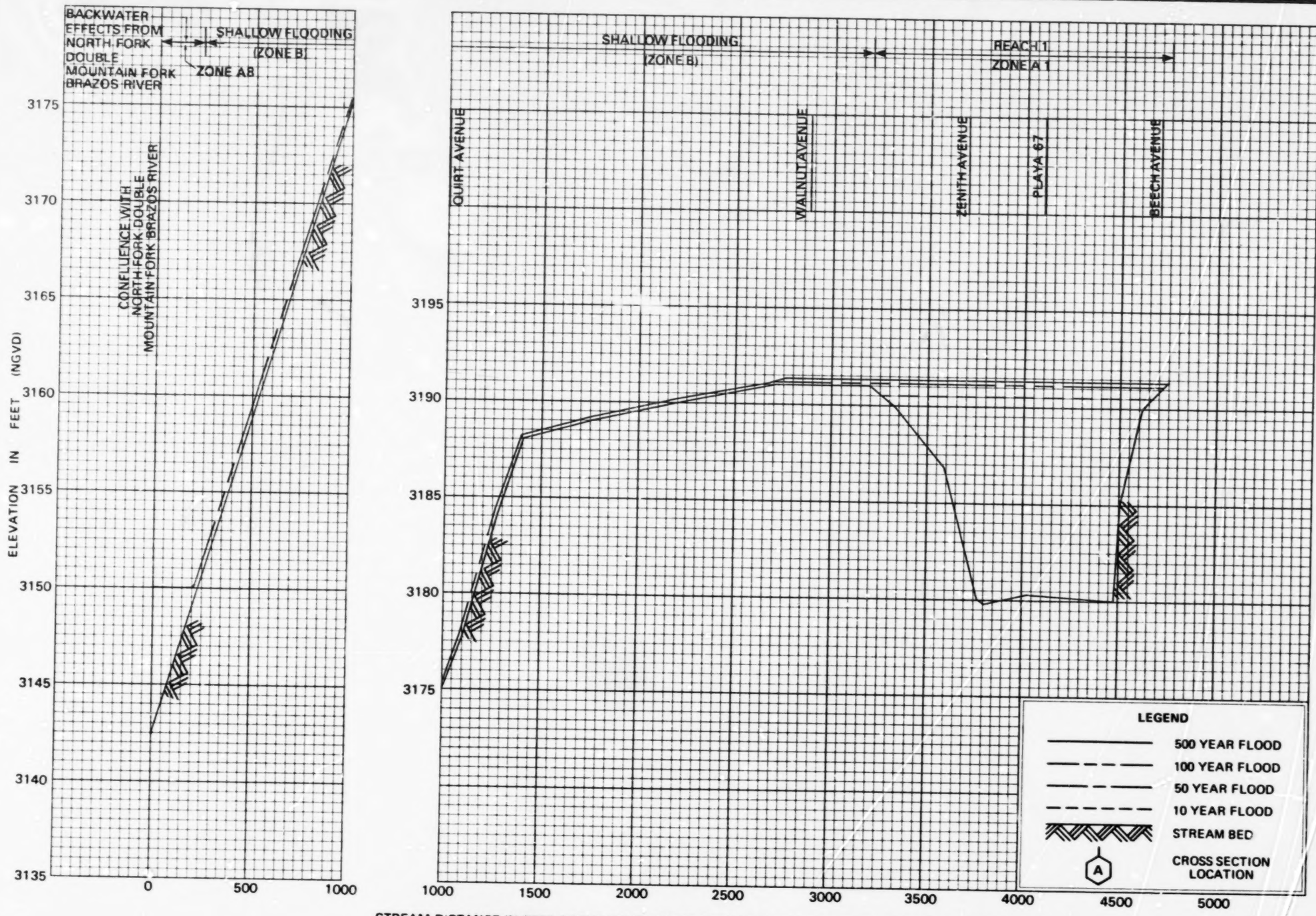


FLOOD PROFILES

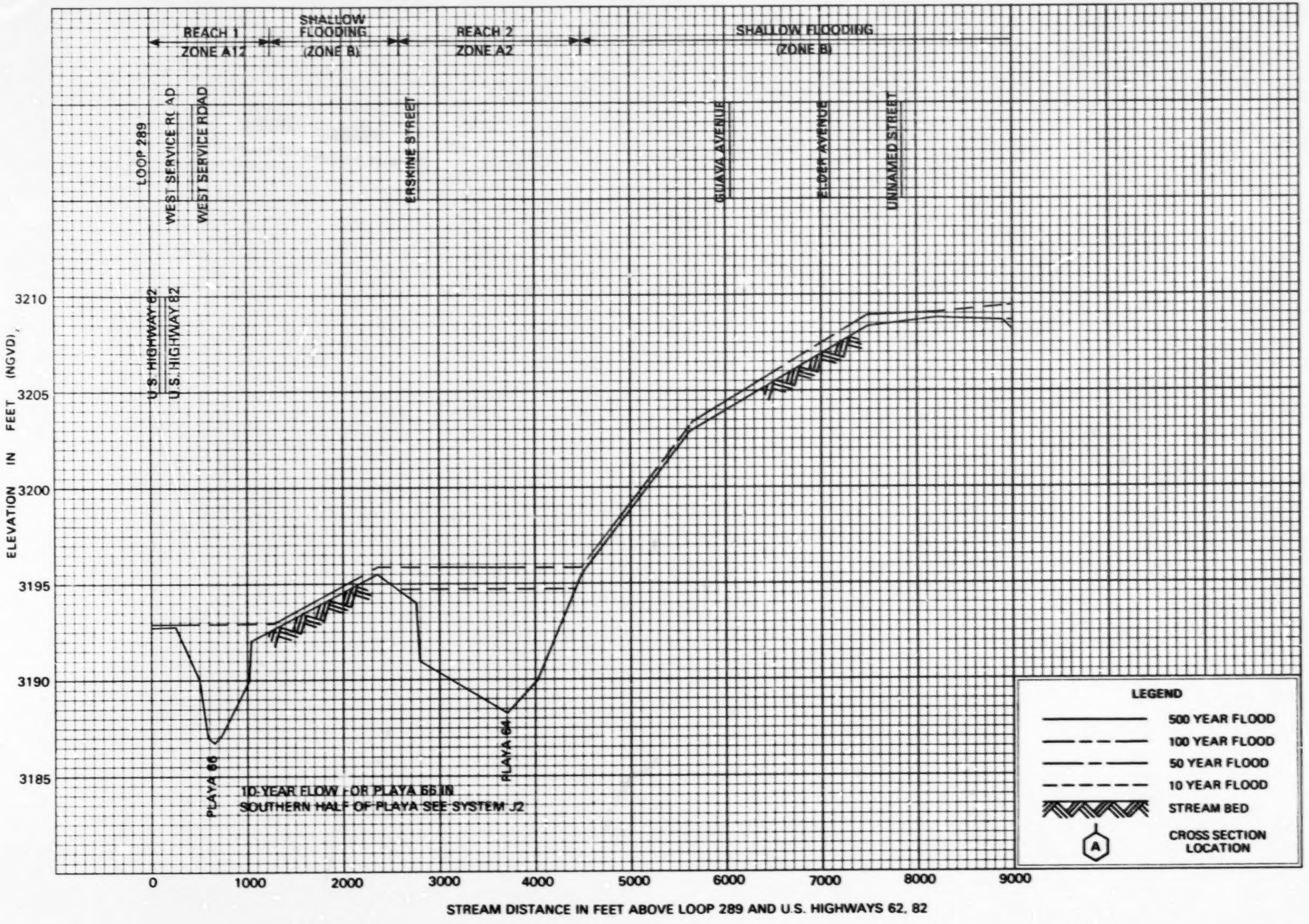
PLAYA SYSTEM I

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

36P

BEST COPY AVAILABLE



FLOOD PROFILES

PLAYA SYSTEM J1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

37P

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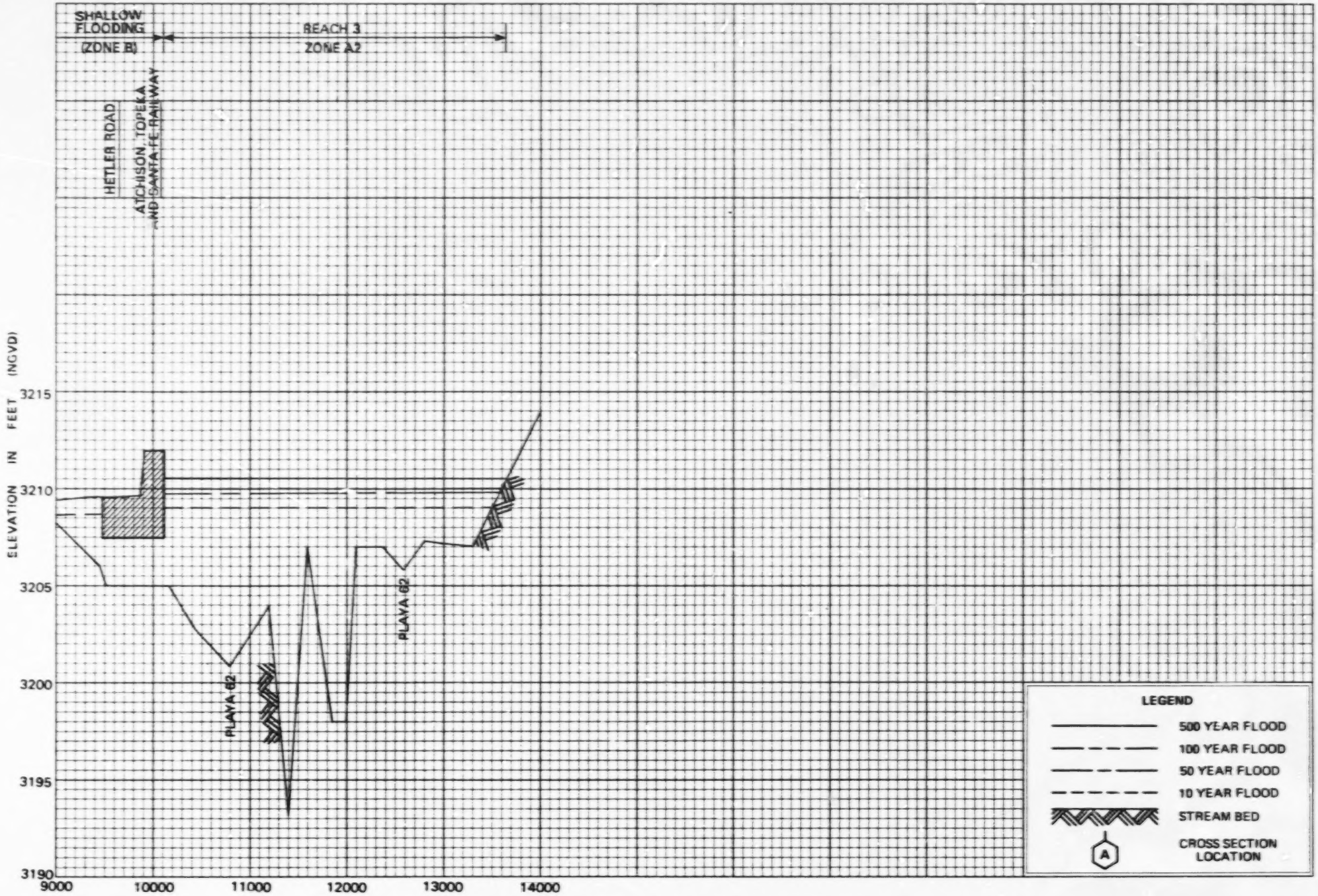

FLOOD PROFILES

PLAYA SYSTEM J1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

38P

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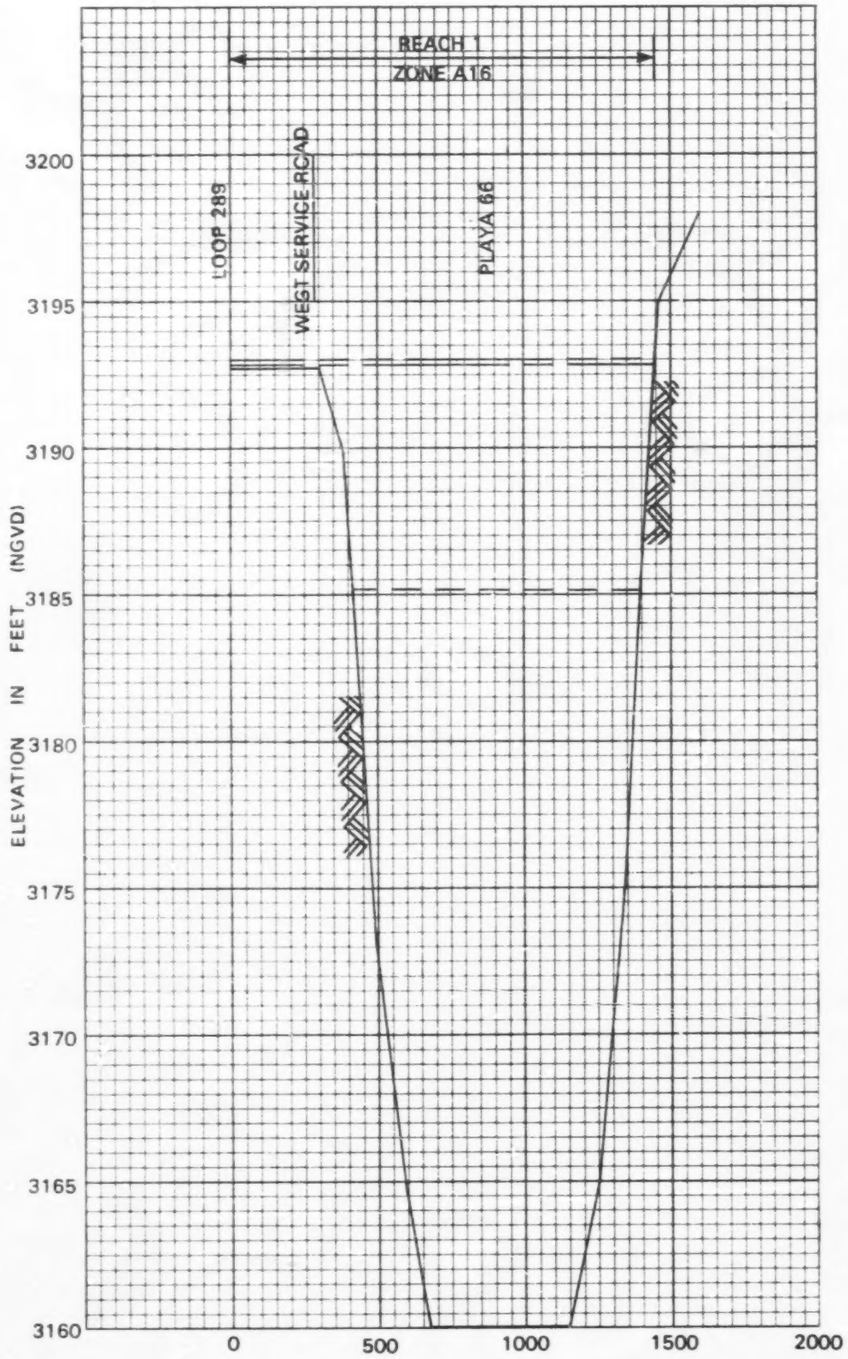

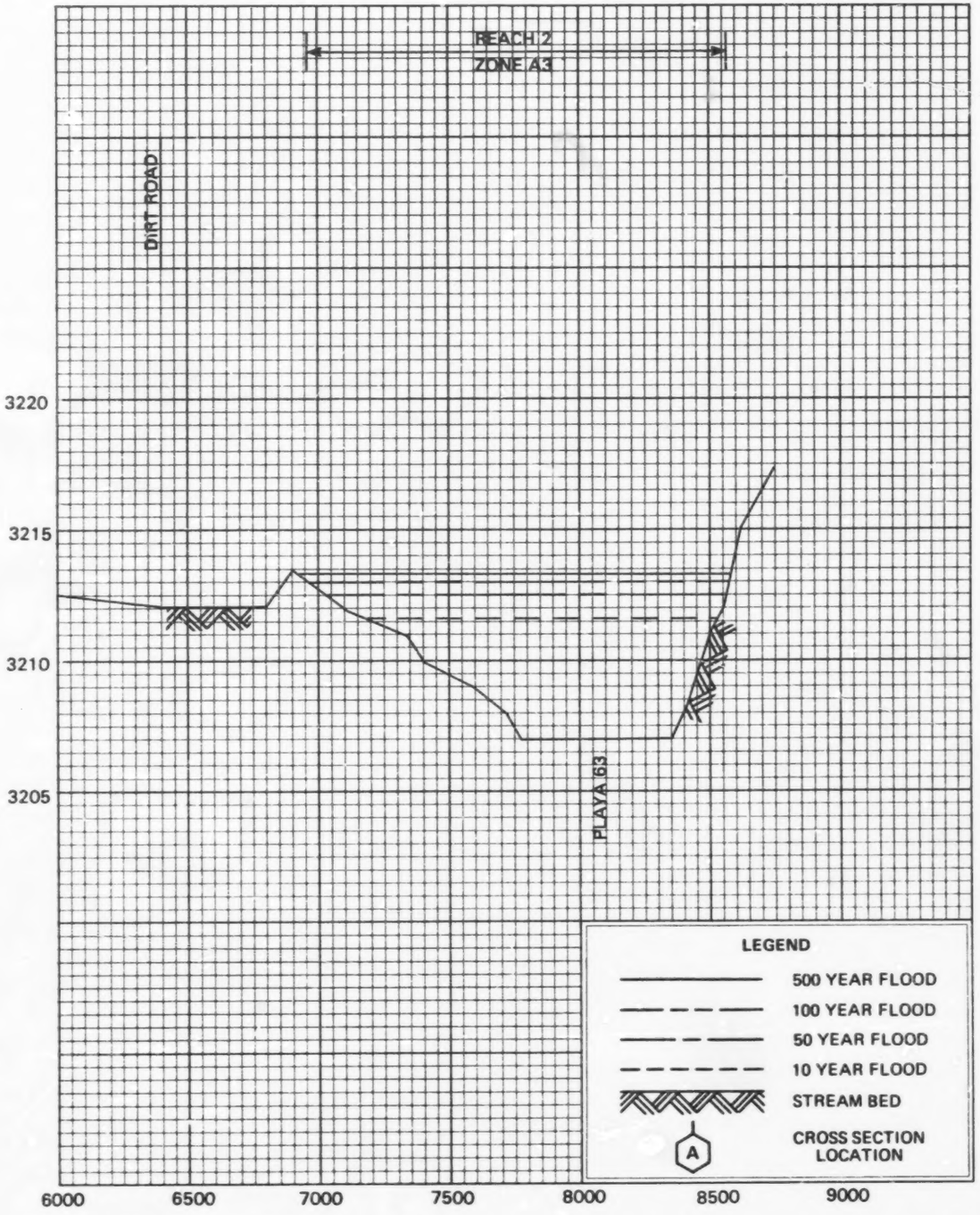

STREAM DISTANCE IN FEET ABOVE LOOP 289 AND U.S. HIGHWAYS 62, 82

FLOOD PROFILES

PLAYA SYSTEM J2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUBBOCK, TX
(LUBBOCK CO.)

39P

BEST COPY AVAILABLE